

SOUTHERN

HORTICULTURE

by

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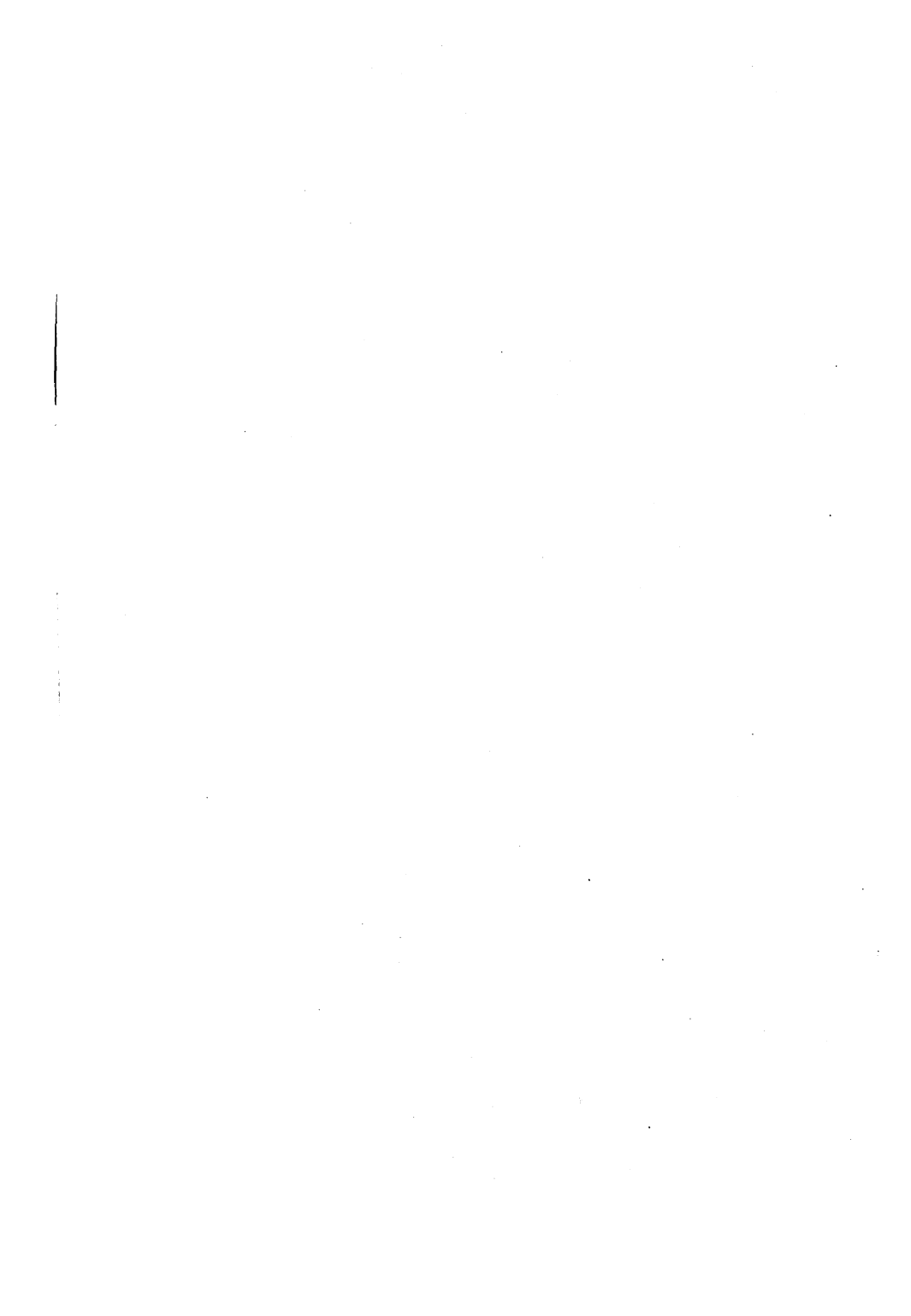
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DEDICATED
TO THE
FARMERS OF TOMORROW

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PREFACE

Horticulture is a phase of farming which has been increasing in importance over a long period of years. An analysis of the nation's agriculture over a period of fifty years shows a marked decline in the relative importance of cotton, swine, and some of the field crops including wheat. During this same period there has been an outstanding gain in both vegetable and fruit production. This trend will continue.

The southern states are famous for their horticultural products. A large portion of the nation's fruits and vegetables come from the South; this is especially true of the crops which are grown during the winter months and those which can be produced in the early spring. In addition, the South is known for its apples, peaches, pecans, figs, watermelons, and berries. To bring our farming systems into better adjustment with market demands, the production of horticultural crops must continue to increase. And, in addition to selling the fresh products as has been so largely true in the past, processing establishments for the canning and freezing of these products will increase until this method of marketing becomes far more important than at the present time. Young men seeking to prepare themselves for successful agricultural careers should take all of these things into consideration.

This new text is very timely. It will contribute to the nation's food supply in a period of emergency when added fruit and vegetable crops are in great demand. But the demand for fruits and vegetables will remain at a high level after the emergency is over. We have never produced—on all farms—enough of these foods to

provide an adequate diet for the members of the farm family. As we become more nutrition conscious, this lack will be appreciated to an ever-increasing extent. We must have adequate gardens on all farms; we must have more fruit on a home orchard basis.

In using this book as a text it is not necessary to begin at any given point. Emphasis should be placed upon those enterprises which are practical for the locality in which the book is used. The text has been developed along the lines of the "jobs" involved in each production enterprise. References, and suggestions for work activities, are given at the end of the concluding chapter dealing with each enterprise.

Dr. H. P. Stuckey, the author, is an eminent horticulturist who has devoted his life to the study and production of the crops about which he writes. In 1926, with C. D. Matthews, he prepared the textbook *Horticulture* which has been widely used by teachers and students of vocational agriculture. In the preparation of *Southern Horticulture* Dr. Stuckey has been assisted by the members of the staff of the Georgia Experiment Station. He wishes to acknowledge this assistance and express specific appreciation to Dr. J. G. Woodroof, food technologist; Drs. H. L. Cochran, F. F. Cowart, and E. F. Savage, associate horticulturists; Dr. L. C. Olson, associate agronomist; T. L. Bissell, entomologist; J. G. Futral, assistant agronomist; Miss Edith Slights, Statistical Clerk; and Mrs. Edna Howard Olson, librarian. Mrs. Kathryn Gaines Cooley assisted in the preparation of the manuscript and in reading proof.

PAUL W. CHAPMAN, *Editor*

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CHAPTER I

PEACHES—SELECTING THE LAND

Job 1—Selecting the Land for a Peach Orchard

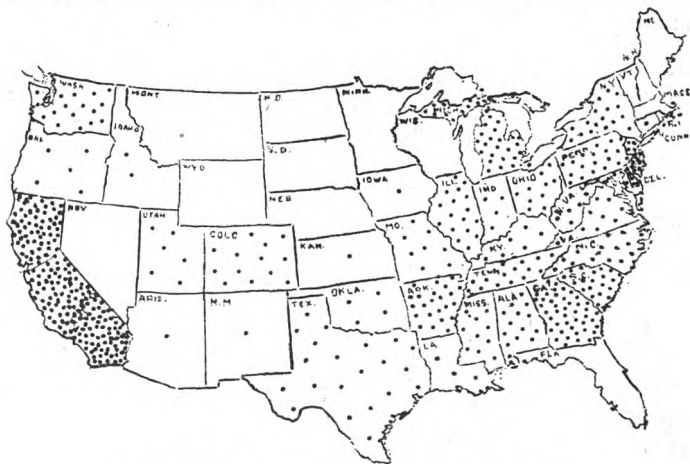
Peach growing is a business distinct from general farming. Before starting into the peach business there are three questions the prospective grower has to consider. First, is he in a region adapted to peach growing? Second, is his land adapted to peach growing? Third, has he the capital and can he give the time and attention necessary to raise a profitable crop? If he can answer these questions affirmatively then he is on the road to success in his venture.

The Distribution of the Peach.—In determining whether or not any particular region is adapted to peach growing it is well to begin by considering where peaches are grown. Today there are only two states, North Dakota and Minnesota, in the United States in which some peach trees are not found. Georgia leads with 8,587,681 trees and California is a close second with 8,335,502 trees. The orchards are on a commercial basis in approximately 35 states, while in at least 25 the number of orchards is sufficient to be an important factor in the state's agriculture.

The South is generally recognized as the peach section of the country and on many farms peaches have supplanted cotton as the money crop. The following table shows the total number of peach trees reported by the Census of Agriculture for 1940 in the various southern states:

<i>State</i>	<i>Total Number of Peach Trees</i>
Alabama	2,240,727
Arkansas	4,612,888
Florida	192,188
Georgia	8,587,681
Kentucky	1,609,819
Louisiana	668,276
Mississippi	1,433,887
North Carolina	3,610,385
Oklahoma	1,314,380
South Carolina	2,608,308
Tennessee	2,434,113
Texas	5,303,837
Virginia	2,054,921

While this table shows the number of peach trees found in the southern states, it does not show the relative adaptability of the different states to peach growing. In each of these states there are thousands of acres of



PEACH PRODUCTION IN THE UNITED STATES

Each dot represents 100,000 bushels.

undeveloped land equally as suitable to peaches as those lands now growing this crop. In recent years the prices received by the growers have not warranted a general increase in the acreage devoted to peaches.

•Regions Not Adapted to Peaches.—Temperature at the different seasons of the year is a vital factor in the determination of the adaptability of any given region for peach growing. Regions that have grown peaches successfully for a period of ten or more years may be considered adaptable to this fruit as far as the climate is concerned. Regions that have been found unsafe for commercial peach growing are those in which protracted warm periods occur during the winter and those in which temperatures of well below 0° F. are of common occurrence. Frequently both the fruit buds and the peach trees are injured more severely from cold in the extreme southern border of the commercial peach growing territory, along the Atlantic and Gulf Coastal Plains where the climate is normally very mild, than in the upper Piedmont and mountainous regions where the winter temperatures are normally much lower. This is easily understood when the warm periods of weather often occurring in the Coastal Plains during the winter are considered. At this time growth will start to the extent of swelling the fruit buds and starting some cell activity beneath the bark in the cambium layer. The succeeding cold, even though rather slight, will be very likely to injure the tree in this tender state.

Regions in which severe spring frosts occur year after year in blossoming time are not suited for commercial peach growing. Those sections with very little altitude and rather level lands ordinarily have climatic conditions which cause the peach trees to blossom very early in the spring. Peach trees in blossom will stand a light

frost but not a heavy freeze. If it is found that the average date of the last winter or spring freeze comes after the blossoming period of the peach trees of that section, the region is not adapted to commercial peach growing.

Influence of Bodies of Water.—Land located near large and deep bodies of water has a decided advantage for peach growing. The ameliorating influence of the water largely prevents frost injury to the peaches. A body of deep water absorbs much heat during the summer, cools off more slowly in the fall than the surrounding atmosphere, and so tends to maintain an even, equable temperature during the colder parts of the year. In a like manner, water warms more slowly than the surrounding atmosphere in the early spring and tends to hold down the temperature. This delays the blooming of the trees and enables the blossoms to escape late frosts. The region around such a body of water is very likely to be climatically adapted to peaches even though the region as a whole is subject to severe spring frosts and rapid changes of temperature. In such a region elevation is of less importance because of the influence of the water on the temperature of the adjacent land.

The Adaptability of a Particular Farm to Peach Growing.—Transportation facilities, the slope and elevation of the land, and the type of soil are mainly questions of the adaptability of a particular farm rather than a region to the commercial growing of peaches.

Transportation.—How far is the land from the shipping station? This should be the first problem considered by the prospective peach grower. The peach, unlike cotton and corn, is a perishable crop. It must reach the market in good condition for satisfactory sale.

Formerly, four or five miles was considered the maximum distance for hauling peaches from the orchard to the shipping station, but with the building of hard-surfaced roads and the improvement in the methods of hauling, greater distances can now be covered with reasonable safety to the fruit. But it must be borne in mind that the expense of hauling any great distance cuts down the profits. Land that is near competing transportation companies is very desirable for peach orchards, as the service is likely to be better.

If the orchard is on the main line of the railroad, distance from the markets is not such an important matter. By using refrigerator cars and shipping the peaches in carlots the fruit can be delivered in good condition to the large centers of population in almost any part of the country. No commercial grower can afford to depend upon the nearby markets alone for the sale of his crop.

Elevation.—Peach orchards should not be located in valleys or on low-lying lands. Hillsides and narrow plateaus bordered by rather deep valleys should be selected where possible. Table lands or any area elevated considerably above surrounding lands is to be preferred for it affords what is called *air drainage*. Cold air, being heavier than warm air, will drain from such areas to the valleys below. This is especially important in regions subject to late frosts, for after a late drop in temperature it has been found that the fruit buds on the elevated areas are unhurt, while those in the adjacent lowlands have been severely injured by the cold air drained from the elevated region. There may be some apparent exceptions to this rule from the fact the orchards located on greatly elevated areas where they are exposed to the prevailing winds will be injured from the extremely low temperatures that occur in such

places, while those trees that are below the crest of the ridge are protected from the cold winds and yet receive sufficient air drainage for protection against ordinary spring frosts.

The elevation of the orchard above the immediately surrounding land is of more importance than the eleva-



PEACH ORCHARD PLANTED ON THE CONTOUR

tion above sea level. This is due to the fact that areas greatly elevated above sea level may lack adjacent lowlands to receive the air drainage from the orchard.

Very steep and badly broken hillsides should be avoided. Generally such soils will erode beyond control and the inconveniences and expense in carrying on the necessary orchard operations are excessive.

Slope.—Shall I plant my trees on land that slopes toward the north or toward the south? This is a question often asked by the prospective peach grower. No

one slope seems to be generally better than another. In regions subject to very low temperatures and strong winds there is some advantage in locating the orchard on a slope away from the prevailing winds. In sections where winter sunscald is a serious problem, southern



WELL CULTIVATED PEACH ORCHARD

and southwestern slopes are to be avoided and northern or northeastern slopes given preference. If the region is subject to late spring frosts which commonly occur after the peach trees blossom, there will be some advantage in placing the orchard on the northern slope for it will tend to retard the blooming date of the trees. The question of slope is of much less importance than several other factors in the proper location of a peach orchard.

Soil Adaptation.—The peach is adapted to a very wide range of soils. A fertile, well-drained, sandy loam or sandy clay loam with a clay subsoil is preferable for peaches. However, profitable commercial orchards are found on some of the heavy clay loams and clay soils.

On flat, poorly drained land the roots of peach trees are quite restricted to the upper layers of soil and the trees suffer greatly during periods of drought. Orchards on such land are short-lived and unproductive. The sandy soils may be used if heavily fertilized, but they do not retain moisture well during periods of dry weather, and the soluble plant food leaches out rapidly following excessive rains. In addition, sandy soils afford favorable conditions for the spread of the root-knot nematode which attacks the roots of peach trees.

The Peach Grower Must Become a Specialist.—

After the prospective peach grower has determined that the region is adapted to peach growing and that his farm is suited to this particular enterprise, he has yet to consider the labor and capital required to make a success.

The man who engages in peach growing on a commercial scale must be a specialist. This means that after his orchard comes into bearing he must confine his efforts largely to this one crop. Growers who have attempted large acreages in cotton or tobacco, together with peaches, find that no one of these crops can be given sufficient attention and labor at the critical stages to make them profitable.

Peach growing requires equipment that can be used for few other crops. In addition, peach growing is very exacting on the time and attention of the grower for a large part of the year. This is especially true during the spraying and harvesting seasons, both of which require careful, personal supervision. The grower must keep informed on the best methods of fertilizing, spraying, packing, and harvesting the crop as practiced by successful growers, and by state and government experiment stations. He must keep in touch with the commission men and the cooperative marketing associations so

as to market his crop to the best advantage. He must arrange for sufficient labor to harvest his crop. In fact, there are so many details requiring attention in peach



Courtesy of G. C. Starcher

A 53-YEAR-OLD ELBERTA PEACH ORCHARD STILL IN PROFITABLE BEARING

growing that only men of unusual executive ability should attempt to plant large acreages to other money crops, if they would be successful peach growers.

Number of Acres Required for Commercial Peach Growing.—Twenty acres set to one variety of peaches is the minimum for a commercial orchard. This will enable the grower to ship in carlots at each harvest. If less than this is set he will have to depend upon nearby markets which are likely to be glutted when his peaches are put on the market, or ship in cars with some of his neighbors. Sixty to seventy-five acres are considered sufficient for an average orchard where one or more varieties of peaches are set.

Capital and Labor Required.—It takes four years and an estimated expense of \$150 an acre to bring a peach orchard into bearing a commercial crop. For this reason, a grower preparing to plant a commercial orchard may find it necessary to arrange for some capital and labor to operate the orchard until it comes into bearing.

The following table gives the approximate or average costs per acre of buying land, setting a peach orchard, and taking care of it through the ninth year:

COST OF PEACH ORCHARD PER ACRE, WHEN FROM 50 TO 60 ACRES ARE PLANTED

Year	Cost of Land	Cost of Trees	Cost of Setting	Cost of Pruning	Cost of Fertilizing	Spraying		Cost of Weeding	Cultivation		Total Cost	Yields
						No.	Cost		No.	Cost		
First.....	\$40.00	\$7.50	\$3.00	\$1.00	\$4.00			\$1.50	5	\$5.00	\$61.00	
Second.....		1.00	.50	2.00	7.00	1	\$3.00	2.00	5	5.00	20.50	
Third.....				3.00	10.00	1	3.50	3.00	5	5.00	24.50	1-2 Crates Per Tree
Fourth.....				4.00	14.00	5	17.50	4.00	5	5.00	44.50	1-2 Crates Per Tree
Fifth.....				4.00	15.00	5	17.50	4.00	5	5.00	45.50	2-4 Crates Per Tree
Sixth.....				3.00	15.00	5	17.50	4.00	5	5.00	44.50	3-5 Crates Per Tree
Seventh.....				3.00	15.00	5	17.50	4.00	5	5.00	44.50	3-6 Crates Per Tree
Eighth.....				3.00	15.00	5	17.50	4.00	5	5.00	44.50	3-6 Crates Per Tree
Ninth.....				3.00	15.00	5	17.50	4.00	5	5.00	44.50	3-6 Crates Per Tree

Figures of costs for one orchard, of course, may be very different from those of another, since these must vary with the location and with the managing ability of the owner.

Supply Crops for the Orchard.—In estimating the number of acres to be set to an orchard, the grower should estimate also the amount of additional land needed for supply crops. Every peach grower should produce the food required by the family, and the feed necessary to care for the stock. This is simply good business. Every pound of lard, every ton of hay that must be bought reduces the net profit on the orchard. The following table can be made the basis for estimating the number of acres required for the supply crops. It is calculated from figures obtained by the United States Department of Agriculture in a survey of the amount of foodstuffs required on the average southern farm.

FARM MAINTENANCE CROPS *

Acres required to grow the foodstuffs and feed required for a family of 5 adult persons, 2 cows, 3 hogs, 25 hens, and 2 mules:

<i>Crop</i>	<i>Acres</i>
Corn with peas	13½
Oats	4
Wheat	4
Legume hay	8
Cotton seed	6
Permanent pasture	7
Sweet potatoes	½
Irish potatoes	⅓
Vegetables	⅔
Fruit	½

The corn, oats, and wheat in the table may be grown on the bottomlands of the farm as these are too low for peaches. The cowpea or soybean hay may be grown after the harvest of wheat and oats. Limited areas of

* Chapman's Farm Crops, page 6.

cotton for supplying the cotton seed, as well as lint, can be grown between the rows of young peach trees and on any unoccupied uplands of the place. Both bottom-lands and broken hillsides may be planted to pasture grasses and used for permanent pastures. It is best that land near the home be reserved for the production of small areas of such crops as sweet potatoes, Irish potatoes, vegetables and home orchard fruits.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. What conclusion can you draw as to the adaptability of the peach to soil and climate?
2. Where is the peach found in the United States today? Name the largest peach-growing state.
3. In how many states is peach growing done on a commercial basis?
4. How many peach trees are reported for your state?
5. Is this considered a large or small number?
6. Why has so much land that is adapted to peach growing been left undeveloped?
7. What two general types of regions in the South are not suitable for peach growing?
8. Explain why northern Florida is not adapted to peaches?
9. Name other similar regions.
10. Why is land about a deep lake considered good peach land?
11. Should a peach grower attempt to grow large acreages of tobacco or cotton? Why?
12. How many acres should be planted to one variety in order to ship in carlots at a harvest?
13. Why is shipping in carlots advantageous to the grower?
14. How many acres are considered an average orchard?
15. How many acres are in the peach orchards of your county?
16. In selecting a site for an orchard, what points should the grower keep in mind?

17. Give two reasons why the orchard should be near a shipping station?
18. How far are the orchards in your county from a shipping station?
19. What advantage has the orchardist on a railroad over one who is forced to market his crops in the surrounding towns?
20. How does elevation give air drainage to an orchard?
21. In what way is air drainage beneficial to a peach orchard?
22. Why are steep, rocky slopes not recommended for peach orchards?
23. What advantage has the northern slope of a hill for peaches? The southern slope?
24. What types of soil are adaptable for peach growing?
25. What types are unfit for peach growing?
26. Why should the orchardist produce food and feed necessary for his family and for his stock?
27. How many years are required for a peach orchard to bear a commercial crop?
28. What are the expenses for an acre during each of the unprofitable years?
29. Estimate the total cost of an orchard of 60 acres before it bears a profitable crop.
30. What can be done to offset some of this expense?

SUGGESTED EXERCISES

1. Make a survey of the territory served by the school, recording the number of peach trees, their location, their condition, and the care they have received. Study these data in an effort to conclude whether or not the section is adapted to commercial peach growing or peach growing for home use.
2. Study the weather records of the nearest United States Weather Bureau Station to determine whether the climate of the region is suitable for peach growing.

CHAPTER II

PEACHES—SELECTING THE TREES

Job 2—Selecting Peach Trees for an Orchard

The job of selecting trees for the peach orchard involves the choosing of varieties as well as the problems incident to procuring the trees.

The selection of suitable varieties for the commercial orchard is an important factor in the success or failure of that orchard. When the trees come into bearing, if it is found that for any reason the fruit is not marketable, the orchard will be a total loss, and it will take three years to correct the mistake. Sometimes this has happened through an error in the selection of the proper varieties, and sometimes because the nurserymen sold trees that were not true to name. For this reason, in some states, nurserymen are bonded by law, so that the buyer has some redress if the trees are not as represented.

The Variety Must Be Adapted to the Region.—
A suitable variety must be adapted to the region in which it is to be grown. There are several hundred described varieties of peaches grown in the United States, and each year there are others introduced. Some of these, such as the Elberta, can be grown successfully in almost any section, while others, such as Rochester and Late Crawford, seem to be suited only to localities similar to those in which they originated. A number of varieties are popular for a few years and then for one reason or another drop out of the commercial list alto-

gether, while only those of great merit continue to be planted over a period of many years. The experiment stations in practically all the southern states maintain variety peach orchards for the purpose of testing the adaptability of the different varieties for their respective sections, and any grower who is in doubt about a given variety, or who desires information on the subject, should apply to the nearest experiment station or agricultural college. Fortunately for the peach grower, there are a few varieties that can be planted with good results in practically every peach-growing section of the South. The four most popular, named in the order of their ripening in the latitude of Atlanta, Georgia, are Mayflower, ripening in late May; Early Rose, ripening the middle of June; Hiley, ripening in early July; and Elberta, ripening from mid-July to August 1.

A Commercial Variety Must Be Prolific.—To be profitable, a variety must be prolific. A variety may be grown exclusively for its quality in a home orchard, but it takes quantity as well as quality to make a commercial variety succeed. There are a number of varieties, such as J. H. Hale, which are readily sold, but which, when grown for commercial purposes, are too difficult of cultivation to produce profitably.

Market Adaptability.—A third point to consider in selecting a variety is whether or not it is suited to the market where it is to be sold or to the purpose for which the peaches are to be used. Most markets prefer yellow-fleshed peaches, so that those varieties which have white flesh usually have slow sale where they must compete with yellow-fleshed varieties. If the peach is intended for canning, a yellow-fleshed variety of an even color is preferred. Some canners object to the red coloring found near the seed in a number of the yellow-fleshed

varieties. The freestones are more easily prepared for canning, but the clingstones make a more attractive pack. Growers in California have created a demand for peaches of the yellow-fleshed, clingstone varieties,



Courtesy of G. C. Starcher

A WELL-SHAPED YOUNG PEACH TREE

such as Philips and Walton, with a uniform, golden yellow flesh and practically no red tinge near the seed. Where distant markets are to be supplied, the variety must be a good shipper. This quality, together with other points, has made the Elberta peach famous.

Ripening Dates of a Variety Most Important.—

The ripening date of a variety is a fourth and possibly the most important point to consider in selecting a variety for the commercial orchard. This date must not conflict with the ripening date of other varieties in the same orchard. If a grower wishes to ship fruit throughout the longest possible period, it is essential that the varieties be so selected that they will give him a continuous supply of fruit throughout the season. The variety must not conflict with the ripening date of varieties in other regions with which the fruit has to compete. Some districts owe their prominence and importance as peach-growing centers principally to the fact that some of the favorite market varieties ripen in these districts at a time when there is relatively little fruit being marketed from other districts. Most extremely early varieties of peaches are of poor quality. For this reason the grower should guard against having his peaches compete on the markets with the later and better varieties grown south of him, which ripen at the same time. An illustration of this is given in the Elberta from Georgia, a favorite variety, competing on the eastern markets with the New Jersey Greensboro, only an average variety. Even in the same state a similar competition often results as when the south Georgia-grown Early Hiley and Hiley compete on the markets with the Uneeda and Early Rose grown in north Georgia. Such competition is always to the disadvantage of the grower of the inferior peach.

Number of Varieties to Grow.—The number of varieties to grow depends upon the number and type of farm operations that are conducted on the place. If the grower has a supply of labor living on the farm and desires to keep this labor occupied in the peach orchard

for the greater part of the summer, three or four varieties should be selected so that they will ripen in sequence and prolong the shipping period over several weeks. For this purpose the Mayflower or Uneeda, followed by the Early Rose, Early Hiley, Hiley, and Elberta, will give almost a continuous shipping season from the latter part of May to late July.

On the other hand, if the grower has only a limited supply of labor on his farm, one and possibly two varieties are all he should attempt to grow. In that case he can employ his graders and packers from another region, and by gathering a large force make a quick job of the harvesting and packing. For this purpose, the Elberta, which is the leading commercial variety for the entire country as well as for the South, is a good selection. If two varieties are to be grown, the Hiley and Elberta make a continuous harvest.

Varieties for the Home Orchard.—For the home orchard the quality of a variety and the date of ripening should be considered, as it is important that the family be supplied with peaches throughout the summer. The following varieties named in order of their ripening will give fruit from May until September: Mayflower, Mikado, Early Hiley, Hiley, Elberta, and Late Elberta. This list is only suggestive, for in each community there are favorite varieties which the individual grower will prefer. These can be substituted for those in the list, the ripening date of which is the same.

A FEW COMMON VARIETIES OF PEACHES

Mayflower. The Mayflower is the earliest of all peaches. It ripens the last week in May in the latitude of Atlanta, Georgia. It is always desired in the home orchard because of its earliness of ripening. It is medium in size, round, very

juicy, with white flesh and clingstone. It has a dark red blush with mottlings of red on the sunny side. The stone, which often splits, is large.

Early Rose. The Early Rose is another early variety which ripens about ten days after the Mayflower and is a good peach in the home orchard to follow it in ripening. This is a beautiful red-colored peach with white flesh and clingstone. Fruit of this variety is shipped to nearby markets and some in refrigerator cars to distant markets. It has a better flavor and is sweeter than the Mayflower.

Carman. The Carman has better flavor and is sweeter than the Mayflower, but it is rapidly losing popularity as a commercial peach because of its low dessert quality.

Hiley. The Hiley ripens about two weeks after the Carman and is one of the prettiest peaches grown. It is slightly oblong, not quite as large and more pointed than the Carman. When grown in the sunshine the fruit is heavily marbled and splashed all over with red. It is a freestone, white-fleshed peach of good quality and is a good shipper. The Hiley is an important commercial variety in the South.

Early Hiley. This variety is very similar to the Hiley in most respects with the exception that it ripens a week earlier than the regular Hiley.

Belle. The Belle is one of the standard commercial varieties and is good for shipping long distances. It is a little larger, somewhat more round, though less highly colored, than the Hiley. It has white flesh, is of excellent quality, freestone, and ripens about a week after the Hiley.

Elberta. The Elberta is the peach that every southern boy and girl should be able to recognize both by looks and taste. It is grown in almost every state in the United States and is grown as extensively in the South as all other varieties combined. It is the best shipper of all varieties. It was originated at Marshallville, Georgia, and is so well known by its yellow flesh, freestone, red-blushed cheek, pointed tip, and large seed

that further description is unnecessary. The Elberta is not, however, an ideal peach for the home orchard because of its lack of sweetness and general unattractiveness of flavor. It is excellent for home canning.

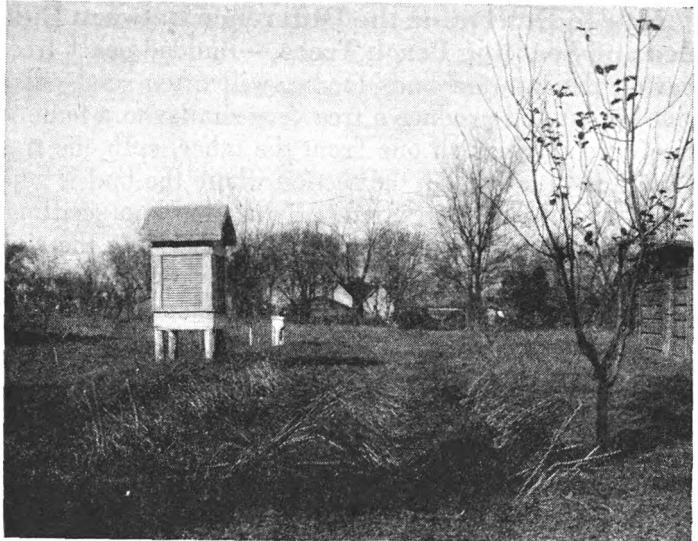
Where to Obtain the Trees.—The grower may propagate his own trees as described in the chapter which follows. However, most peach growers find it more convenient and more profitable to buy their young trees from a reliable nurseryman. Other things being equal, the trees for the orchard should be bought as near as possible to the place where they are to be planted. This saves transportation costs and often affords a personal inspection of the nursery and trees before buying. Very little importance need be attached to the influence of any particular region upon nursery peach trees. The inherent qualities of a variety do not change with the regions in which they are grown. If a variety is hardy to cold, prolific, and resistant to disease, it will not be made less so by growing the nursery trees in any particular region.

Tree Grades and Sizes.—It is generally thought that large trees are best for planting, but almost the reverse is true. Most of the commercial peach orchards of the South are set to "June bud" trees. Stocky plants ranging in height from 24 to 36 inches are desirable sizes. However, trees ranging from 18 to 24 inches are used with almost equal results. One- and two-year-old trees, ranging from three to six feet in height are generally sold in small lots for planting in home orchards and on city or town lots. The larger nursery trees are more expensive to handle and in the end are no better than the smaller trees. Regardless of size, the trees should be stocky and well-developed, both in the top and root systems.

How to Determine the Difference Between Budded and Seedling Peach Trees.—Budded peach trees having the inserted buds to die, will often send out a side sprout and produce a tree very similar to a budded tree. To distinguish one from the other, split the tree along the pith through the section where the bud is supposed to have been inserted. If the tree is a seedling, the pith will be continuous from the stock into the cion on top; while if it is a budded tree, there will be a segment of wood between the pith of the stock and that of the cion.

Trees Should Be Rigidly Inspected for Insects and Diseases.—The trees should be rigidly inspected for insects and diseases before they are purchased. Root-knot nematode and crown gall, both of which cause various knots and enlargements of the roots, are two maladies that should be guarded against. Trees affected with scale insects, especially San Jose scale, that attack the tops of the trees, and borers that attack trees at the base, should be avoided.

Handling the Trees When Received.—Orders for the trees should be placed early in the season while the nurseryman has a large stock from which to select. The trees should arrive at the orchard not later than December. If they cannot be planted immediately, they should be "heeled in." To heel in trees or plants they should be laid on the soil and the roots placed in a trench large enough to allow the moist soil to be placed between all the interstices of the roots. Then the trench should be filled with mellow soil deep enough to cover the roots well and prevent freezing. When finished, the trees are in a reclining position. The trees can be taken from this trench, a few at a time, as they are needed for planting. While trees are out of the soil it is highly



Courtesy of O. I. Snapp

THE METHOD OF "HEELING IN" PEACH TREES

important to prevent injury to the roots by exposure to the drying influences of the wind and sun. Wet sacks spread over the roots of the trees while they are out of the soil will protect them sufficiently.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Why is the selection of suitable varieties for the commercial orchard important?
2. What four points should be considered in selecting the varieties?
3. How can you find whether or not a given variety is adapted to your section?

4. Name some varieties not suitable for commercial purposes.
5. Give two reasons why the Elberta is suited to most markets.
6. Would the Elberta suit the canneries in California?
7. Give two reasons why the ripening date of a commercial peach should be considered by the grower.
8. Give instances of peaches from various sections competing on the markets.
9. How can a grower determine the number of varieties it is best to grow?
10. Name the varieties in their order of ripening that will give a continuous harvest from May to late July.
11. What varieties are generally selected where only one or two varieties are grown?
12. Name the varieties in the commercial peach orchards near your home.
13. What varieties have you in your home orchard?
14. From what locality should a grower purchase his trees? Why?
15. What size trees should you buy?
16. What diseases of the root should you guard against?
17. What insects that attack the tops should you guard against?
18. What care should be taken of the trees as soon as they arrive?

SUGGESTED EXERCISES

1. Make a survey of the community and determine what percentage of the peach trees are seedlings and what percent are budded trees. Also determine the names of the varieties grown and which are best for the section.
2. Visit the nearest peach nursery and study the grades and sizes of the trees, as graded by the nurseryman.
3. Bring budded and seedling peach trees into the classroom. Split some of each through the pith at the point of union of bud and stock to demonstrate the difference.

CHAPTER III

PEACHES—PROPAGATION

Job 3—Propagating the Peach

An important decision the peach grower must make is whether he will propagate his own nursery trees or buy them from a nurseryman. If he decides to grow his own nursery trees, it is necessary to begin one year before the trees are to be planted, for it requires the full growing season of a year to grow nursery peach trees from the seed, bud them, and have them ready to set to the orchard in the fall.

The usual method of propagating the peach is to plant peach seeds, called pits, and bud the seedlings with buds from a desirable variety during the first summer's growth of the seedlings.

Growing Nursery Trees a Specialized Business.

—The growing of nursery peach trees is a business very distinct from the growing of a peach orchard. The orchardist begins where the nurseryman leaves off, for the nurseryman's finished product—his trees—are the trees with which the orchardist begins.

The growing of nursery trees gives quick financial returns, and offers the vocational student in horticulture a job which, if necessary, he can complete within one year.

Formerly, it was the common practice to use seedling peach trees for the home orchard. It is still practiced to a limited extent, especially in districts far removed

from peach tree nurseries. Practically all commercial peach orchards, however, are grown from budded trees.

Choosing the Soil for a Peach Nursery.—A fertile, sandy loam soil with a clay subsoil is desirable for a peach nursery. The soil should be very fertile so as to give the peach seedlings a rapid, vigorous growth in order that they may become large enough to be budded in the early summer. This will afford the inserted buds time to make nursery trees large enough for orchard planting the following fall.

Clay soil should be avoided for a peach nursery, as it often becomes necessary to dig nursery peach trees when the ground is wet in late fall and winter. Sandy loam soils are injured very much less from being stirred under such conditions than clay soils.

Where to Get the Peach Pits for Planting the Nursery.—Peach pits for nursery purposes are obtained from two chief sources: (1) from thickets of uncultivated seedling peach trees found in the mountainous regions of Tennessee, North Carolina, and certain other states; and (2) from peach canneries.

Pits from seedling peach trees are usually preferred for they not only contain a greater number to a bushel but also are thought to germinate better than pits from the commercial varieties. There are about 7,000 pits in a bushel from seedling peach trees, and only about 2,500 in a bushel from the commercial varieties. It takes from seven to ten bushels of pits to plant an acre nursery. Nurserymen grow good trees from both these types of pits, and when the supply from one source is short they use the other.

When and How to Plant the Pits.—As soon as feasible after the peach pits are harvested they should

be stored in boxes of moist sand and held until planted in the nursery in October or November. Peach pits planted in the fall remain in contact with the moist soil all through the winter and are ready to germinate as soon as the weather turns warm in the spring.

Nature sets a good example in planting peach pits. This is illustrated by the peaches falling from the trees and decaying, leaving the pits in close contact with the soil where they often become partially covered with soil from the beating rains and remain moist all through the winter. Here they are subjected to the freezing weather of winter which helps to crack the shells and facilitates germination when the weather turns warm in the spring.

It is best to follow nature in this respect and not allow the peach pits to become excessively dry from the time they are harvested until they are planted in the nursery rows. A few weeks of dry storage will do little if any harm; but when they are kept stored in a dry, warm place all the winter their percentage of germination is likely to be greatly reduced.

Preparing the Land and Planting the Pits.—In preparing the land it is well broken and harrowed first, and then laid off into rows from three and one-half to four feet apart. A shovel or bull-tongue plow about four inches wide is used for this purpose. A heel-pin slide or some similar attachment for leaving the furrow open should be used on the plow.

The peach pits are dropped from five to eight inches apart in the bottom of these furrows and covered from two to three inches deep. The same plow used for opening the furrows may be used for covering the pits by running two furrows to the row, ridging on them. However, a great deal of time can be saved by using a double-footed plow which will ridge the rows by throwing

soil from both sides of the furrow at the same time.

Nurserymen planting large acreages with peach pits often use planters drawn by mules, which plant two rows at a time.

Planting Peach Pits in Winter and Spring.—In some instances the grower of nursery trees may not be able to get possession of desirable land for his peach nursery before late winter or early spring. Even under these conditions he need lose very little time for he can allow his peach pits to remain buried in moist sand (where they are undergoing practically the same changes as if planted) until he gets his land ready for planting. Peach pits thus held in moist sand and planted in late winter or very early spring will germinate almost as early as if planted in the fall.

Sprouting Peach Pits in Hotbeds.—Where small quantities of peach pits are to be planted, the seedlings can be started earlier in the spring by sprouting the pits in hotbeds. By this method the pits are kept in moist sand until late January or early February. They are then planted very thickly in hotbeds which have a temperature of about 75° F. The warm temperature of the hotbeds will cause the peach pits to sprout in the very early spring. As soon as the danger of spring frosts has passed and the soil outside becomes warm, the young peach seedlings and sprouting seeds are transplanted to the nursery. By this method the actual planting of the nursery may be delayed until spring and yet the seedlings will be started earlier than by planting the pits in the nursery in the fall.

Fertilizing the Peach Nursery.—A fertilizer rich in nitrogen or ammonia should be used in the peach nursery to make the young trees grow rapidly. If a

supply of stable manure is available, about 25 tons to the acre applied broadcast and turned under when the land is plowed will be beneficial.

Where commercial fertilizers are relied upon a mixture containing about 8 percent nitrogen, 8 percent phosphoric acid, and 6 percent potash should be used. This should be applied in the drills and well mixed with the soil just before the peach pits are planted. From 600 to 800 pounds to the acre will be found about the correct rate of application.

If the young seedlings show a lack of thrift, they should receive a side application of a nitrogenous fertilizer, as nitrate of soda or sulphate of ammonia, during the latter part of May. About 100 pounds of nitrate of soda or 75 pounds of sulphate of ammonia will be suitable for this purpose.

Cultivating the Nursery Trees.—Cultivation should begin before the peach seedlings come up in the spring. A spike-tooth harrow or weeder is first run over the land across the rows. This will kill any weed growth which may be starting and also break the crust of soil and partially level the ridges over the rows which will aid the young seedlings in coming up. As the seedlings grow they are given frequent shallow cultivations very much as cotton and truck crops are cultivated. Implements used for cultivating cotton may be used for cultivating the peach nursery.

If the nursery is well fertilized and cultivated, the seedling trees should be large enough to bud in early June.

Budding Peach Seedlings.—Peach seedlings budded in June or early July will make a top growth of from 12 to 36 inches before frost. These are then sold as "June budded" trees and are ready for setting to the

orchard at any time in the late fall or during the winter. By selling his trees as June buds, the nurseryman can grow and sell a crop of nursery trees each year.

How Peach Trees Are Budded.—Peach trees are budded by making a vertical slit about an inch long in the bark of the seedling just above the ground. At the upper end of this slit a short horizontal cut is made forming a T-shape. This T-shaped cut is made for receiving the bud which is to be inserted. The seedling is called the “stock.”

A twig of the current year's growth, containing well-developed buds, is cut from a tree of the variety to be propagated. The leaves are removed from this twig, leaving pieces of the stems about a third of an inch long attached. This twig is called the “bud stick.” A bud is removed from the bud stick with a thin-bladed, sharp knife. Begin one-half inch below the bud and cut upward the same distance above the bud. Cut just deep enough to remove a thin shield of wood beneath the bud.

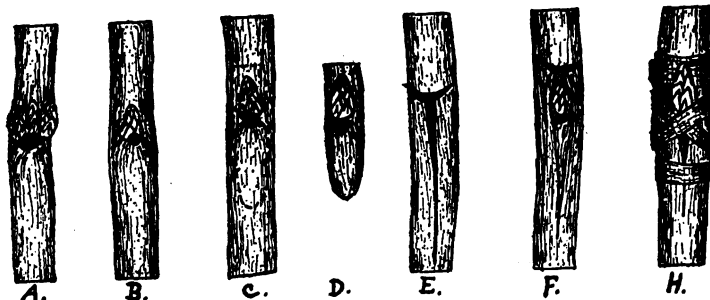
The corners of the vertical cut made on the stock are now pried up with the point of the knife and the bud slipped into place. The bud is now tied in position with raffia, soft cotton string, or a special type rubber band, and the top of the seedling is slightly broken over several inches above the bud to aid in forcing the bud into growth.

The buds should be cut from the bud stick only as they are used, and the greatest care should be exercised in not injuring them in the process of inserting them in the stocks.

Peaches can be budded more rapidly if the budder has some one to tie the buds in place for him as they are put in.

At the end of about ten days or two weeks after bud-

ding, the strings are removed to avoid girdling the young trees. A very good method for doing this is to cut the string from the opposite side of the tree from the bud with a sharp knife.



BUDDING PEACHES

(a) A fruit bud; (b) a leaf bud; (c) the method of cutting the bud; (d) the bud; (e) the method of cutting the stock; (f) the bud properly placed; and (h) the bud properly wrapped.

When to Cut Off the Tops of the Seedlings.—

As soon as the inserted buds start into growth the tops of the seedlings are cut off just above the bud. The time when this is done will vary with the vigor of the trees and the weather conditions. However, they are usually removed in four or five weeks after the trees are budded.

It is well to look over both the seedlings and the budded trees every two or three weeks and rub off unnecessary sprouts or side shoots to force the trees into the proper shape.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. How are the commercial varieties of peaches propagated?
2. Why are orchards not set to seedling trees?

3. If you desired to bud some trees in June 1944, when would you plant the seed?
4. When would these trees be ready to be set to the orchard?
5. What kind of soil is best for a nursery? Why?
6. Where do the nurserymen obtain the pits for planting?
7. What difference is there between the pits of seedling trees and those of commercial varieties? How many pits does it require for planting an acre?
8. How are the pits planted by nature?
9. What preparation should the land receive before the pits are planted?
10. How far apart should they be planted?
11. If the pits cannot be planted until late winter and spring, what treatment should the pits receive until then?
12. Give the method of sprouting pits in a hotbed. What advantage has this method?
13. What fertilizers should be applied to the peach nursery? At what rate?
14. What cultivations should the seedlings receive?
15. When should peach trees be budded?
16. Why should the seedling be slightly broken above the bud?
17. When should the strings be removed from the seedling?
18. How soon after budding should the tops of the seedlings be cut off?
19. What care should the seedlings receive the remainder of the summer?

SUGGESTED EXERCISES

1. Visit nearby nurseries and study methods of planting peach seeds, types of soil used, methods of budding, and implements used.
2. Collect peach pits from seedlings and from improved varieties. Store a few of each outdoors in moist sand and leave a few in the warm, dry schoolroom. Plant a number from each lot early the following spring and note difference in time and percentage of germination.

3. Bring vigorously growing sprouts from peach trees into the classroom and practice T-budding. The work may be extended to the nursery after a few practice periods in the classroom.

CHAPTER IV

PEACHES—PREPARING LAND AND SETTING TREES

Job 4—Preparing the Land and Setting the Trees

After ordering the trees, the next job is the preparation of the land for setting them. This should be done four or five weeks before the trees are to be set in order that all vegetable matter may be turned under and the soil become settled and compact before tree planting begins.

The land should be as thoroughly broken and harrowed in preparation for planting peach trees as for cotton or any of the intensely cultivated truck crops. The importance of such preparation is emphasized when we consider: (1) that the land immediately under the peach tree is to be plowed for the last time in the life of the orchard; (2) that peach trees get a very large proportion of their plant food from the upper strata of soil reached by the plow; and (3) that peach tree roots have a much greater spread than the tops and meet in the space between the rows of trees, thus occupying all the area of the orchard by the time the trees come into bearing profitable crops.

Taking Out the Stumps.—If newly cleared land is planted to peaches, it may be necessary to take the stumps out of the strips where the tree rows are to be laid out and leave the others to partially decay. These can be taken out later by the regular orchard help during slack seasons. Except for this compromise, the

spaces for the tree rows should be prepared very thoroughly. They should be made wide enough that the young trees will run no risk of being injured during the process of removing the stumps from between the rows. However, land should be cultivated to some other crop for at least one year before setting it to peach trees.



*Courtesy of Bureau of Plant Industry, Soils, and Agricultural Engineering,
United States Department of Agriculture*

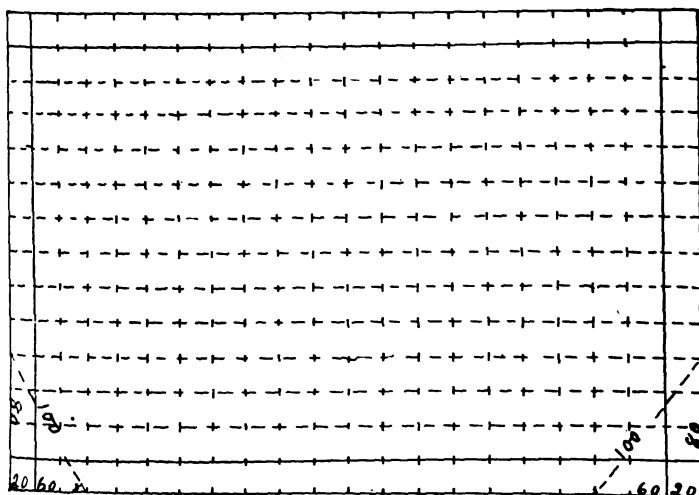
PREPARING LAND FOR PLANTING AN ORCHARD
Turning under cover crop of rye with disk plow.

Terracing Peach Land.—Land which is very hilly or rolling should be terraced as it is broken. The terraces should be located sufficiently near together to hold the surface drainage. Very broad terraces over which spray outfits can be drawn are to be preferred to the narrow ridge terraces which obstruct practically all orchard machinery in moving up or down the hill from one hill to another. On such lands, the rows of peach trees are run with the terraces. Short rows of trees are used to fill in the broad spaces between the terraces, just as with the field crops.

Time to Set the Trees.—November, December, and January are considered the three best months for setting

out peach trees in the South. However, the work can be done from the first of November to the first of March with fairly good results. In the more elevated regions, trees can sometimes be planted successfully as late as the first of April. More than a hundred peach trees were set out at the Georgia Experiment Station, located in middle Georgia, as late as April 3, and all of them lived.

Clay loam soils when wet cannot be worked without



LAYING OUT AN ORCHARD BY THE "CHECK" METHOD

injury. Consequently, rainy weather delays tree planting on such soils. Freezing of the soil seldom retards tree planting for more than a few days at a time in the chief peach-growing centers of the South.

A tree planted in November or December will have formed sufficient callous and new roots by the following spring to give it a hold on the soil and to enable it to start top growth immediately when spring opens.

Laying Out the Orchard.—There are three principal forms for laying out a peach orchard: (1) the square, (2) the hexagonal, and (3) following the contour of the land where it is rolling and terraced.

Setting trees in squares and checks is the simplest and most often used method where the land is fairly level or moderately rolling. The hexagonal method of planting trees is very rarely used in any section. Following the contour with rows of trees is very applicable to hilly or mountainous land.

The Square Method.—The first step in laying out an orchard by the square method is to select the longer side of the field from which to begin. Here a straight line should be staked out where the first row of peach trees is to be located. This line should be about 20 feet from the border of the field to allow ample room for cultivation and other orchard operations. A stake, which is set at each end of this line, is commonly called the base line. By sighting from one of these stakes to the other, additional stakes, located about 20 feet apart may be lined upon this base line so that each stake will be located where a peach tree is to be set.

The next step is to square the cross rows from the base line. A square corner is established by forming a 60-80-100-foot triangle with a cord or wire. This is done by measuring 60 feet back along the base line and holding one end of a 100-foot cord at this point; then hold one end of an 80-foot cord at the corner. Bring the two loose ends of these two cords together and they will meet at a point where the cross line, which is at right angles with the base line, is to be established. By sighting from the corner through this point, the cross line can be staked out across the field.

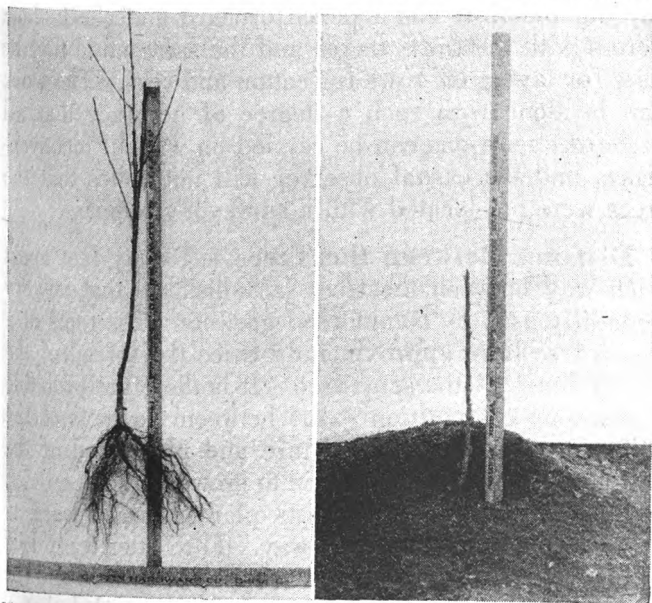
A cross line at the other end of the base line is estab-

lished by the same method. The fourth side, across the field from the base line may be put in by squaring on one of the cross lines.

The next step is to measure off the distances along the lines on all four sides of the field where the trees are to stand. To locate the places for the trees, one man stands back of the base line and another back of one of the cross lines. A third man holds a stake which is sighted into place. This operation is continued until stakes locating each tree of the entire planting are sighted into line.

Setting Trees with the Contour of the Hills.—

In setting rows of trees with the contours of the hill it is far more difficult to locate the trees at even distances



NURSERY PEACH TREE READY TO BE PLANTED (*left*) AND TREE PLANTED AND HEADED-BACK (*right*)

apart. However, an experienced plowman can lay out the rows at a fairly uniform distance apart. The distances between the trees in the row can be measured easily.

Where the orchardist insists on accuracy in locating his trees, whether it is laid out in checks or with the contour of the hills, it may be advisable to secure the use of a surveyor's instrument.

A Simple Method of Laying Out the Orchard.—Experienced peach growers seldom resort to surveyors instruments. A trustworthy mule and a Negro plowman with long experience in laying off straight corn and cotton rows are to be found on almost every farm that employs a large number of workers. This plowman can lay out the rows for a peach orchard and check them across with the same stakes and the same mule that he uses for laying off rows for cotton and corn. The work can be done with such a degree of accuracy that all orchard operations can be carried on without inconvenience, and the casual observer will not notice that the trees were not located with a surveyor's compass.

Distance Between the Trees.—Twenty feet apart each way between the trees is a distance that is very generally used by commercial growers. The roots of a peach tree have approximately twice the spread of the top or limbs of the same tree. It is therefore probable that strong competition exists between the roots of the different trees for the moisture and plant food of the soil long before the tops begin to crowd.

Formerly, some orchardists planted peach trees as close as 16 feet apart each way. For better control of insects and fungus diseases that attack the peach, and for longer-lived orchards, it is generally conceded that a distance of 20 feet and preferably 23 feet between trees

is desirable. Trees require less space on thin land than on fertile land which stimulates a vigorous growth.

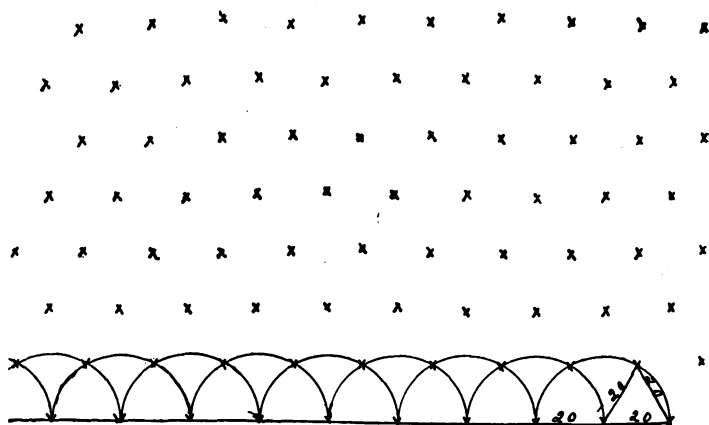
Making the Holes for the Trees.—Where the entire field is deeply broken and well harrowed, it is entirely unnecessary to dig large holes for setting peach trees. All that is necessary is to dig the holes large enough to allow the roots of the young trees their natural spread when planted. One comparatively rapid method is to plow out a deep furrow along the rows by means of a large “middle buster” or some similar type of plow which will throw out a very deep furrow. This plow may be drawn by two or four mules, depending somewhat upon the texture and condition of the soil. These furrows should be cross-checked by a small bull-tongue or similar plow drawn by one mule. The intersection of the two furrows will show where the trees are to be placed.

Planting the Trees.—Small peach trees, ranging from two to three feet in height, a popular size with commercial peach growers, are easily and rapidly planted. After the rows have been opened deeply with the “middle buster” and cross-checked with a small plow, showing the location for the trees, the planting can be most conveniently and rapidly done by two men working together. One man with a shovel throws out two or three shovelfuls of soil where the tree is to be planted, while the other man who carries the trees trims off the broken and badly bruised roots of a tree and places it in the hole. The second man holds the top of the tree in an upright position and packs the soil around the roots with his feet as it is thrown in by the man with the shovel. Topsoil, comparatively free of trash, dead grass, etc., is used for this purpose. The two men then move on to plant the next tree, one carrying the shovel

and the other the trees, and repeat the operation at each intersection of the two furrows.

Where the rows are very long, it is necessary to have a third man with a supply of trees in a wagon. This wagon may be driven along through the field in order to deliver the trees to the planters as needed. In hauling the trees to the field, the roots should be kept covered with wet sacks or kept packed in wet sawdust to prevent drying out.

Heading Back the Trees.—Young peach trees are usually headed back or topped after they are transplanted. In this way they can be cut to a more uniform height than if headed back before planting. Peach trees are usually cut back to a height of from 16 to 18 inches above the ground when they are planted. It has been estimated that if the peach pickers' feet have to be raised as much as 12 inches above the ground in order to reach the fruit, the expense of picking peaches is doubled. Obviously, low-headed trees are popular with commercial growers.



LAYING OUT AN ORCHARD BY THE HEXAGONAL METHOD

Cutting the Trees.—When it has been decided how low the trees are to be headed, the operator can cut them to a uniform height very conveniently by placing his knee near the tree and clipping off the tree just below the height of his kneecap. With a little practice, he can clip them off very rapidly, using the height of his knee somewhat as a guide. June-budded peach trees are cut back to a single switch. One-year or larger trees which are considerably branched are cut back to the desired height with a few of the side limbs spurred back to a length of four or five inches. These spurs ultimately form the framework of the tree.

Replanting Missing Places in a Peach Orchard.—If peach trees are properly planted very few will die the first season. The few that die, however, should be replaced with young trees the following fall or winter. This will give almost a perfect stand of trees, and there should be very little replanting to do thereafter.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. When should the land be prepared for setting the trees?
2. Why should the land be thoroughly broken and harrowed?
3. On new land which stumps should be taken out first?
4. Where some stumps are left on the land, why should there be a wide space between the stumps and the rows of peach trees?
5. What kind of land should be terraced?
6. What kind of terraces should be made? Why?
7. What months are considered best in which to set peach trees in the South?
8. What other months for setting trees will give fairly good results?

9. What conditions of the soil delay the setting out of trees in winter?
10. What are the two principal forms for laying out a peach orchard?
11. On what kind of land are each used?
12. Draw a diagram on the blackboard showing the different steps in laying out an orchard by the square method. Instead of a triangle 60-80-100-foot form use a 6-8-10-inch one or one in the same ratio.
13. How would you proceed to lay out the rows and find the location of the trees by the contour of the hill method?
14. Give a simple method of laying out an orchard.
15. What is the most popular distance apart for setting trees?
16. How many trees to the acre are there if set 20' x 20'? 17½' x 17½'? 18' x 20'?
17. What advantages has the greater distance?
18. What size holes are suitable for planting peach trees?
19. How would you proceed in setting out an acre of young peach trees?
20. After the young tree is in place in the hole, what kind of soil do you put in first?
21. When are the young trees headed back?
22. To what height are they cut back? Why?

SUGGESTED EXERCISES

1. Visit nearby peach orchards to study types of terraces used. Study also the method the orchardist uses for laying off the terraces and the implements used in their construction.
2. Study comparative costs of digging out stumps and blowing them out with dynamite.
3. Secure young peach trees from a nursery, study the root system, set a few trees, and head them back according to methods described in the text. Seedling trees, which may be gotten without cost, may be used for this practice work.
4. Secure a ball of twine and practice the square method of laying out a peach orchard as described in the text.

CHAPTER V

PEACHES—FERTILIZING THE ORCHARD

Job 5—Fertilizing the Peach Orchard

The young peach trees should be fertilized the following spring after being set. This is in addition to any fertilizers applied to the crops grown between the rows of trees. They should also be fertilized early each spring thereafter as long as the orchard is maintained. Some growers follow the practice of making a summer application of a fertilizer high in nitrogen, as nitrate of soda or sulphate of ammonia, in addition to the fertilizer mixture applied in the early spring.

The job of fertilizing the peach orchard involves three important problems: what plant food to buy, what form of fertilizer to buy, and how and when to apply the fertilizer.

Elements Required for Growth of Peach Trees.

—Before selecting a fertilizer mixture for peach trees a careful study should be made of the plant food elements required by the peach tree and which of these should be applied to the soil by the grower in order to produce large crops of marketable peaches.

Peach trees, like other plants, require for their growth the following elements: (1) carbon, (2) hydrogen, (3) oxygen, (4) nitrogen, (5) phosphorus, (6) potassium, (7) calcium, (8) iron, (9) magnesium, (10) sulphur, (11) manganese, (12) boron, (13) copper, and (14) zinc. Most soils, when first cleared from the forests, contain enough plant food elements to grow good crops

of peaches without the addition of anything in the form of a fertilizer. After being cultivated a few years these soils become deficient to a varying degree, in nitrogen, phosphorus, and potassium. It is therefore the practice of fertilizer manufacturers to put up fertilizers containing these three fertilizer elements. A fertilizer containing nitrogen, phosphorus, and potash is called a complete fertilizer.

Sources of Fertilizer Elements.—There are several sources from which the fertilizer manufacturers get fertilizer elements for manufacturing commercial fertilizers.

Nitrogen or Ammonia.—Nitrogen or ammonia is obtained from such materials as dried blood, tankage, fish scrap, cottonseed meal, nitrate of soda, and sulphate of ammonia. The dried blood and tankage are slaughterhouse by-products. The fish scrap is made from low grade fish dried and ground. The nitrate of soda is obtained from deposits mostly in Chile, South America. Sulphate of ammonia is reclaimed from gas coming from coke ovens in connection with the manufacture of steel. The nitrogen of the air is another source, being resorted to more and more each year. The air is about three-fourths nitrogen. Electrical processes have been devised by which the nitrogen may be extracted from the air and used for fertilizer. Lime or calcium is one of the materials used for combining with the atmospheric nitrogen. This is sometimes called lime nitrate. Cyanamid is also one of the fertilizer products from the recovery of atmospheric nitrogen. It has been proposed to use the power generated at the dam across the Tennessee River at Muscle Shoals, Alabama for the manufacture of fertilizer from atmospheric nitrogen.

Phosphoric Acid.—Phosphoric acid is manufactured from phosphate rock. Beds of this rock are found in western states, Florida, and Tennessee. The phosphate rock is treated with sulphuric acid which makes the phosphoric acid soluble and available for plant growth. It is sometimes finely ground and sold as ground rock phosphate. Animal bone and basic slag are other but less important sources of phosphoric acid.

Potash.—Potash is manufactured in America from brines in lakes and deposits in a number of the western states. Searls Lake, California supplies a large percentage of American potash. The brine from this lake is evaporated and the residue refined into high-grade muriate of potash. A very large percentage of our muriate of potash, sulphate of potash, and kainit is mined in France and Germany and imported by this country.

What Plant Food to Buy.—Soils vary greatly in their content of plant food and also in their ability to release or give up, for the use of the plant, that which they contain.

When in doubt as to the kind and proportions of plant food a certain soil type needs, the grower should write to the agricultural college or experiment station of his state. The practices of successful growers in that particular region will also be a guide for the beginner.

After the grower decides the kinds and amounts of plant food his soil needs, he should select those materials which will give him available plant food elements, in the proportions desired, at the lowest cost.

Chief Sources of Plant Food.—The chief sources of plant food are: (1) organic, such as animal manures and cover crops; and (2) inorganic, such as commercial fertilizers.

Animal manures, as stable manure or barnyard manure, are excellent for soil improvement but are not generally available in sufficient quantities to be of any considerable importance to commercial peach growers.

Cover crops have an important place in a soil improvement program and are discussed in connection with cultivating the peach orchard.

Commercial Fertilizers.—The term “commercial fertilizer” is used in the same sense as “chemical fertilizer,” and constitutes such materials as acid phosphate, nitrate of soda, sulphate of ammonia, tankage, muriate of potash, sulphate of potash, and kainit.

Peach growers rely very largely upon commercial fertilizers for maintaining the fertility of their orchard soils. Consequently, large quantities of commercial fertilizers are bought by the peach growers each year. The average rate of application of fertilizers for peaches is heavier than for ordinary farm crops. It is estimated that the peach growers use, in the southeastern states, about 200 pounds of fertilizers for each 100 bushels of peaches produced. This, of course, varies with the different soils of peach-growing regions.

What Form of Fertilizer to Buy.—Practically all the experimental work done on fertilizing peaches in the South points to the one conclusion that a fertilizer mixture for this crop should contain nitrogen, phosphorus, and potassium. Such a mixture is called a complete fertilizer.

The fertilizer may be bought from the manufacturers ready mixed, or the ingredients may be bought separately and the mixing done at home. The relative price of the ready-mixed and of the home-mixed fertilizer should largely determine which to use.

The different states require that each bag of fertilizer

be tagged, showing the analysis or amount of plant food it contains. Both the manufacturers and states maintain chemists who analyze samples of fertilizers from the various lots to see that they are kept up to standard. In any case where the grower is in doubt about the composition of a fertilizer he has purchased, he can have samples taken by an official fertilizer inspector and analyzed by the state chemist, maintained by the state for such duties.

Units of Plant Food and Grades of Fertilizers.

—In the fertilizer trade materials are bought and sold by the “unit.” A unit is one percent of a ton or 20 pounds to a ton. Thus, a fertilizer mixture analyzing 4 percent nitrogen, 10 percent phosphoric acid, and 4 percent potash, would be designated as a 4-10-4 mixture, and a ton would contain 4 units of nitrogen, 10 units of phosphoric acid, and 4 units of potash.

A high-grade fertilizer is one that contains a high percentage of plant food. A 4-10-4 mixture, 18 units of plant food, would be of a higher grade than a 2-9-2 mixture, 13 units. There is economy in using high-grade fertilizers; for the same amount of plant food is gotten in less weight, which means a saving in freight charges and less labor in applying it to the soil.

Low-grade fertilizers contain large amounts of inert material, as common soil, which has no fertilizing value. Such materials are called “fillers.” They are added to make a mixture, with a given analysis, up to a ton in weight. Dry fillers often prevent a fertilizer mixture, containing a high percentage of nitrate of soda or similar materials, from caking or becoming hard if it stands some time after mixing. However, dry fertilizer ingredients, which do not absorb moisture very readily, can often be selected to serve the same purpose.

Home Mixing of Fertilizers.—Some of the advantages of home mixing of fertilizers are (1) a better knowledge of the source and grade of materials used; (2) a saving in transportation charges, for by this method fillers are eliminated; (3) usually a lower cost of materials; and (4) the educational value of home mixing, for the grower is certain to learn something about the availability and effects of the different ingredients when he mixes his own fertilizers.

Some of the disadvantages of home mixing fertilizers are (1) a lack of thorough mixing by unskilled labor, (2) the possibility of wrong calculations of formulas by inexperienced persons, and (3) lack of floor space and time to mix when the shipment of fertilizer arrives late and there is a rush to get it out on the land.

How to Calculate Fertilizer Formulas.—The nitrogen in some fertilizer mixtures is given as ammonia and in others as nitrogen. Ammonia is 82.3 percent nitrogen. To convert ammonia into nitrogen, multiply the percentage of ammonia by 0.823; and to convert nitrogen into ammonia, divide the percentage of nitrogen by 0.823, thus:

Nitrate of soda contains 18.84 percent ammonia; then, 18.84 percent ammonia multiplied by 0.823 = 15.5 percent nitrogen. Or, 15.5 percent nitrogen divided by 0.823 = 18.84 percent ammonia.

Suppose it is desired to make up a fertilizer mixture to analyze 6 percent nitrogen, 8 percent phosphoric acid, and 3 percent potash; one-half the nitrogen to be derived from 24 percent sulphate of ammonia, an inorganic form, and one-half from 16 percent dried blood, the phosphoric acid from 16 percent acid phosphate, and the potash from 50 percent muriate of potash. It may be calculated in the following way:

First find out the number of pounds of nitrogen, phosphoric acid, and potash that would be required. Since 2,000 is 20 times 100, we might multiply the percentages by 20.

20×3 (% nitrogen from blood)—60 lbs. nitrogen from blood required for 2,000 lbs.

20×3 (% nitrogen from sulphate of ammonia)—60 lbs. nitrogen from sulphate of ammonia for 2,000 lbs.

20×8 (% phosphoric acid)—160 lbs. phosphoric acid required for 2,000 lbs.

20×3 (% potash)—60 lbs. potash required for 2,000 lbs.

We then divide the pounds of nitrogen, phosphoric acid, and potash by the percentages that the materials analyzed thus:

Nitrogen, lbs. $60 \div 16\% = 375$ lbs. dried blood required.

Nitrogen, lbs. $60 \div 24\% = 250$ lbs. sulphate of ammonia required.

Phosphoric acid, lbs. $160 \div 16\% = 1,000$ lbs. acid phosphate required.

Potash, lbs. $60 \div 50\% = 120$ lbs. muriate of potash required.

Total, 1,745 lbs.

In using such concentrated materials only 1,745 pounds were obtained, 255 pounds less than the ton required. This could be made up by adding some inert substance as a filler. On the other hand, lower grade materials, as kainit, could be chosen for the mixture so as to increase the total pounds.

How to Calculate Percentages from a Given Mixture.—To find the analysis of a mixture made up as follows:

516 lbs. nitrate of soda analyzing 16% nitrogen.

1,000 lbs. acid phosphate analyzing 16% phosphoric acid.

120 lbs. muriate of potash analyzing 50% potash.

1,636 lbs. total.

To determine the number of pounds of nitrogen, phosphoric acid, and potash in the above mixture, multiply as follows:

$$\begin{aligned} 516 \times 15.5 &= 79.98 \text{ lbs. nitrogen.} \\ 1,000 \times 16 &= 160 \text{ lbs. phosphoric acid.} \\ 120 \times 50 &= 60 \text{ lbs. potash.} \end{aligned}$$

To get the percentage of nitrogen, phosphoric acid, and potash, divide the amounts of the constituents by the total amount of the mixtures, thus:

$$\begin{aligned} \text{Nitrogen, lbs. } 79.98 \div 1,636 &= 4.88\% \text{ nitrogen.} \\ \text{Phosphoric acid, lbs. } 160 \div 1,636 &= 9.16\% \text{ phosphoric acid.} \\ \text{Potash, lbs. } 60 \div 1,636 &= 3.66\% \text{ potash.} \end{aligned}$$

Tables for Calculating Fertilizer Formulas Quickly.—There are several kinds of tables devised for calculating fertilizer formulas quickly. Such tables are often timesavers. One taken from PRESS BULLETIN 199 of the Georgia Experiment Station is here given:

Percent of Plant Food in Mixed Fertilizer	Number to Be Divided by Percent of Plant Food in Material Used	Percent of Plant Food in Mixed Fertilizer	Number to Be Divided by Percent of Plant Food in Material Used
1	2,000	7	14,000
2	4,000	8	16,000
3	6,000	9	18,000
4	8,000	10	20,000
5	10,000	11	22,000
6	12,000	12	24,000

This table is used as follows: suppose it is desired to make a 5-6-5 fertilizer mixture from nitrate of soda containing 18 percent nitrogen, acid phosphate containing 16 percent phosphoric acid, and muriate of potash containing 50 percent potash. Under the column labeled "percent of plant food in mixed fertilizer" we

find the figure "5" representing the 5 percent nitrogen which it is desired to have in the 5-6-5 fertilizer. Opposite this 5 we find the number "10,000." Dividing this number by 16, or the percent of available nitrogen in the nitrate of soda, we get 625. This is the number of pounds of nitrate of soda to be used in the mixture. In the same way we find that 750 pounds of acid phosphate and 200 pounds of muriate of potash are required to furnish the phosphoric acid and the potash in the mixture. Adding these three numbers we get 1,545 pounds, which is equivalent to one ton, or 2,000 pounds, of a 5-6-5 fertilizer. If the full ton in weight is desired, 455 pounds of filler could be added. However, this is usually unnecessary for home use since the actual plant food would not be increased. Thus our mixture would be as follows:

625 pounds of nitrate of soda
750 pounds of acid phosphate
200 pounds of muriate of potash.

How to Mix Fertilizers.—It is important to have the ingredients thoroughly mixed. Select a tight barn floor; a concrete floor is preferable. Shovel the lumpy ingredients through a coarse sand screen and beat up the lumps which fall before the screen. Then pour down the bulkiest ingredient first and spread it out. Spread the next bulkiest material on top of this. Continue in this manner until all the ingredients to be mixed are in one pile. Now begin at one side of the pile and shovel the mixture twice over. This will usually complete the mixing. If necessary, it may be shoveled over three or four times. Small mixing machines for this work may be purchased if desired. It is usually best to mix fertilizers only a few weeks before using and always store in a dry place.

Some Fertilizer Ingredients Which Should Not Be Mixed.—To prevent chemical action taking place which causes the loss of plant food, certain fertilizer ingredients should not be mixed together. Some of these are as follows:

Unslaked lime	Should not be mixed with	{	Sulphate of ammonia
Air slaked lime			Animal manures
Hydrated lime			Dried blood
Wood ashes			Tankage
Basic slag			Nitrogenous guanos
Lime nitrate	Should not be mixed with	{	
Unslaked lime			Acid phosphate
Air slaked lime			Dissolved bone
Hydrated lime			
Ground limestone			
Wood ashes	Should not be mixed with (unless applied immediately)	{	
Lime nitrate			Nitrate of soda
Unslaked lime			Muriate of potash
Air slaked lime			Kainit
Hydrated lime			Trono potash
Nitrate of lime			

Kinds and Amounts of Fertilizers to Use for Peaches.—The kinds and amounts of fertilizers to be used for peaches will vary with the composition, type, and fertility of the soil to be fertilized.

It is the practice of some successful peach growers to use about one-half the nitrogen in their fertilizer mixtures from an organic source, as cottonseed meal, dried blood, tankage, or fish scrap; and the other half from an inorganic source, as nitrate of soda or sulphate of ammonia. Recent fertilizer experiments with peaches indicate that for most peach soils there is no appreciable advantage to be gained from this practice. A fertilizer mixture deriving all its nitrogen from a quickly available source, as nitrate of soda or sulphate of ammonia, gives about the same results as where a part of it is derived from an organic source.

In growing peaches on sandy soils which are inclined to be porous and leachy, it is sometimes advisable to

reserve a part of the nitrogenous fertilizer and put it on as a side application in early summer when the peaches are about one-fourth grown. From one to three pounds to a tree of either sulphate of ammonia or nitrate of soda will serve for this purpose. .

Muriate of potash is apparently as good for peaches as sulphate of potash, and is considerably less expensive. Consequently, there is no advantage in buying the sulphate.

Acid phosphate is a satisfactory source of phosphoric acid to be used in a fertilizer mixture for peach trees.

Soils which will absorb and retain large quantities of water will retain fertilizers better than those which are unable to hold moisture. This difference may be illustrated by comparing the water-holding capacity of pure sand with clay and humus or decaying organic matter:

100 pounds of sand will hold 25 pounds of water.

100 pounds of clay will hold 50 pounds of water.

100 pounds of humus or decaying organic matter will hold 190 pounds of water.

Fertilizer Mixtures for Peach Trees.—A fertilizer mixture containing nitrogen, phosphoric acid, and potash in a 1-1-1 ratio, such as a 6-6-6 or an 8-8-8, is generally satisfactory for most soils on which peaches are grown in the South. Usually the heavier soils as the Cecil and Davidson require less potash and more phosphoric acid than do the Coastal Plain soils as the Greenville, Orangeburg, and Norfolk.

Amounts of Fertilizers for Peach Trees of Different Ages.—On soils medium in fertility the following amounts of fertilizers should give satisfactory tree growths and produce fruitfulness if the proper mixtures are used:

- 1-year trees—1 pound per tree in two applications (March and June)
- 2-year trees—2 pounds per tree in two applications (March and June)
- 3-year trees—3 pounds per tree
- 4-year trees—4 pounds per tree
- 5-year trees—5 pounds per tree
- 6-year trees—6 pounds per tree

The quantities should be varied with the fertility of the soil and the growth of the trees. If leguminous cover crops are grown and plowed under the nitrogen in the fertilizer mixture may be reduced. It is well to watch the growth of the trees from year to year and add more fertilizers if the trees show a lack of vigor, or reduce the fertilizers if the growth becomes too rank.

Time and Method of Applying Fertilizers.—It is a common practice to apply fertilizers to peach trees in the early spring just before the trees blossom. However, in some peach-growing districts, it is the practice to withhold the fertilizers until after the trees bloom and the size of the crop can be estimated. Then the fertilizer is applied in amounts according to the size of the crop on the tree. If the crop is killed by frost during the blossoming period, practically all the fertilizer for that season is withheld, applying only enough to give the trees a medium amount of wood growth. This is probably a good practice, since fertilizers containing a high percentage of nitrogen, if applied before the trees blossom, tend to cause peach trees to “set” a bigger crop of fruit than they can mature. In deciding a question of this kind the available supply of labor on the farm at the time the fertilizers are to be put out should be considered.

While the trees are small the fertilizers should be

applied around the trees in a circle a little larger than the spread of the limbs of the tree. After they become four or five years old the roots occupy the entire area and the fertilizers may be broadcast over the entire area and harrowed into the soil with any convenient orchard harrow.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. When should the young peach trees be fertilized the first time?
2. How often should the orchard be fertilized?
3. What are the elements required for the growth of a peach tree?
4. In which of these three are soils generally deficient?
5. What is a complete fertilizer?
6. What are the influences of each of the following fertilizer elements on plant growth: nitrogen, phosphorus, and potassium?
7. How can the grower determine what plant food to buy?
8. What are the three chief sources of plant food?
9. Why do peach growers not use more stable manure?
10. What are commercial fertilizers?
11. Which do peach growers generally use for improving their soils: commercial fertilizers, animal manures, or cover crops?
12. Which of the southern states produces the greatest number of bushels of peaches and which uses the greatest number of tons of fertilizers?
13. What three elements should a peach fertilizer contain?
14. By what means can the grower determine that he is getting the amount of plant food in his fertilizer that he is paying for?
15. What is the unit of plant food?
16. What is meant by a 4-10-4 fertilizer?

17. What is a high-grade fertilizer?
18. What are the advantages and disadvantages of mixing fertilizers at home?
19. By what do you multiply to convert nitrogen into ammonia and ammonia into nitrogen?
20. How are fertilizers manufactured?
21. Show how to calculate and make up a fertilizer containing 6 percent nitrogen, 8 percent phosphoric acid, and 3 percent potash.
22. How would you calculate the analysis of a given mixture of a fertilizer?
23. From the table given in the text, determine how many pounds of 18 percent nitrate of soda, 16 percent acid phosphate, and 50 percent muriate of potash it will take to make a ton of a 4-8-4 fertilizer mixture.
24. How are fertilizers mixed?
25. What fertilizers should not be mixed together?
26. On what type of soils is a side application of a nitrogenous fertilizer in early summer advisable?
27. What importance should be attached to sources of nitrogen and potash in making a peach fertilizer?
28. How do humus and clay in the soil influence its fertilizer and water-holding capacity?
29. How much fertilizer would you put around one-, two-, three-, and four-year-old peach trees?
30. What fertilizer mixtures do the peach growers near you use, and when are the fertilizers applied?
31. How much fertilizer do the peach growers near you put to a tree, and how is it applied?
32. What time of the year should fertilizers be applied?
33. How are fertilizers applied to young peach trees?
34. How are they applied to a bearing orchard?

SUGGESTED EXERCISES

1. After calculating a fertilizer mixture for peaches in the classroom, secure and mix the ingredients according to directions given in the text.

2. Mix a small amount of lime with cottonseed meal or some other nitrogenous fertilizer and place it in a fruit jar. Moisten the mixture, set it aside, and note the smell of ammonia which escapes from day to day. This shows the loss of ammonia when the wrong fertilizer elements are mixed.
3. Collect samples of commercial fertilizers, such as acid phosphate, cottonseed meal, dried blood, fish scrap, nitrate of soda, sulphate of ammonia, muriate of potash, American potash, kainit, etc. Keep them in glass jars and learn to identify each.
4. Secure three glass tubes 24 inches long and about half an inch in diameter. Fill one with sand, one with clay, and one with finely pulverized leaf mold, leaving about six inches space at the top. Fill this space with water and note its rate of penetrating the different substances. This will demonstrate the water-holding capacity and rate of leaching of soils.

CHAPTER VI

PEACHES—CULTIVATING AND PRUNING

Job 6—Cultivating the Peach Orchard

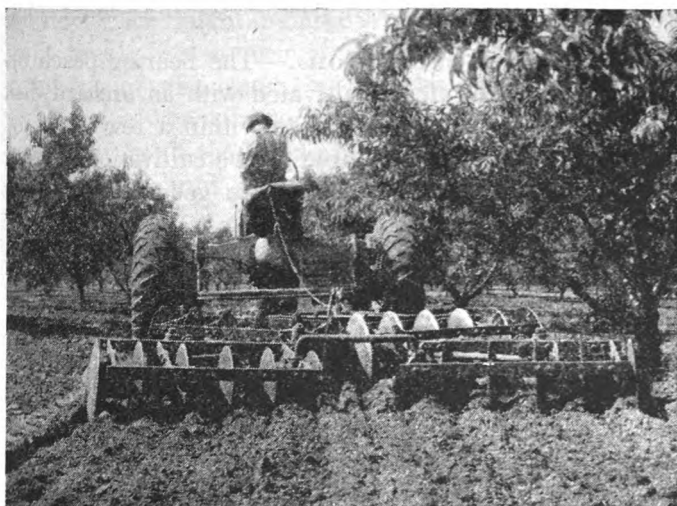
Cultivation of the orchard should begin in the early spring as soon as weed growth begins. The purposes of cultivating a peach orchard are (1) to conserve moisture and nutrients by destroying weeds; (2) to aerate the soil, thus producing favorable conditions for bacterial and root growth; and (3) to destroy insects, such as curculio, which pupate in the soil.

Intercultural Crops.—Most successful peach growers give the necessary tillage to the trees by growing cleanly cultivated crops between the rows of peach trees while they are young. In this way both the trees and crops are tilled at the same time.

Where the soil is not infested with nematodes, cotton is more generally grown in the young peach orchard than any other crop in the South. Low-growing truck crops, such as squash, Irish potatoes, tomatoes, and peppers would serve equally as well. Tall-growing crops, such as corn, should never be grown in the young peach orchard.

Distance of Crops from the Trees.—These intercultural crops should not be planted too near the peach trees. A space of from six to eight feet should be left along each row. It is the practice of some growers to plant five rows of cotton between each two rows of peach trees the first year after the orchard is planted. The second year, three or four rows should be planted

according to the size of the trees. Some orchardists grow crops between the trees the third year, but where the trees are well developed they come into bearing the



Courtesy of O. I. Snapp

USING A GANG DISC HARROW IN THE PEACH ORCHARD

third year and occupy most of the soil area of the orchard.

The intercultural crops are planted, cultivated, and fertilized in the usual way. The peach trees receive an application of fertilizer in addition to that given the crops grown in the orchard.

Cultivating a Bearing Peach Orchard.—The bearing peach orchard is given clean cultivation. Late October and November are the best months for breaking the soil of the orchard for the grower usually has more spare time at this season. In addition, the soil is usually in excellent condition for turning so that he can

plow under grass and weed growth which will decay during the winter.

The plowing is done with a turn plow. The land is broken from four to five inches deep and the soil thrown toward the tree rows.

Number of Cultivations.—The bearing peach orchard is usually clean cultivated with an orchard disk cultivator from early spring to within a few weeks of harvesting time. From three to five cultivations during the spring and early summer are generally sufficient to keep down weeds. After harvest one or two light diskings will suffice to keep down weed growth. The number of cultivations necessary depends upon the season.

Implements for Cultivating the Peach Orchard.—The double disk reversible harrow with an extension beam to enable the operator to cultivate near the trunks of the trees without disturbing the limbs, is frequently used for cultivating the peach orchard. With this implement, the team may walk along, barely touching the spreading limbs, while the disks on the extension beam of the harrow cultivate close up to the trunks of the trees. The larger commercial orchards are generally cultivated with tractor disks and harrows.

Where the orchard soil is well prepared and smooth, the common spike-tooth harrow and spring-tooth harrow will do effective work if used frequently before the grass and weeds make much growth. These harrows do rather poor work after the grass and weeds begin to mat the ground.

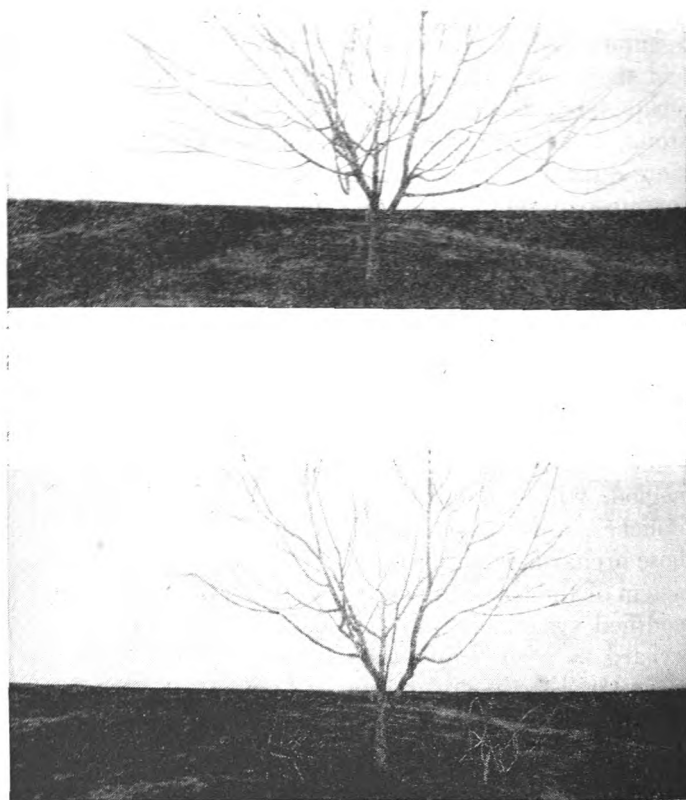
Cover Crops in the Peach Orchard.—Cover crops are beneficial to peach orchard soils. They increase the water-holding capacity, increase the amount of absorption of rainfall, greatly decrease the evaporation of

water by lowering the soil temperature, and reduce the amount of soil erosion. In addition, cover crops help supply organic matter which is necessary for orchard soil maintenance and aid in taking up and holding nitrates which might otherwise be leached from the soil. In addition to these advantages, cover crops have a number of disadvantages. Cover crops use water, and there may not be sufficient moisture available to adequately meet the needs of the tree and the cover crop. Cover crops may possibly make insect control more difficult. The plum curculio, which is responsible for most of the wormy peaches in the South, pupates just beneath the surface of the soil and can be easily destroyed by disking under the spread of the branches from May 10 to July 1.

A modified cover crop system is one in which the tree middles are kept in cover and the tree rows cultivated until such time as the trees have their root systems well established in the soil and are better able to obtain their water requirement from the lower soil depths. This method, with the cultivation under the spread of the branches, aids materially in plum curculio control in those orchards where the pest is serious. After the root system of the tree has become well established using this modified system, it may be possible to plant the whole orchard to a shallow-rooted cover crop without injury to the trees if the cover crop is kept cut to avoid using too much water.

Job 7—Pruning the Peach Orchard

Pruning is considered one of the important fall and winter jobs in the orchard. However, in the young orchard there is some pruning to be done in the spring and summer of the first year.



A PEACH TREE BEFORE AND AFTER PRUNING

The Objects of Pruning.—Peach trees are pruned in order (1) to build up a strong framework for the tree, (2) to admit sunlight for coloring the fruit, (3) to

thin the fruit by cutting out a part of the fruiting branches, and (4) to limit the height and spread of the tree so as to make spraying and harvesting the fruit easier and therefore more economical.

Pruning Year-Old Peach Trees.—Young peach trees, when planted, are headed back as described in Chapter IV. As the tree starts growth the following spring the orchard should be gone over carefully and all unnecessary sprouts near the ground and on the lower part of the body of the young tree rubbed off. This work if started early enough can be done with gloved hands. From four to five sprouts or limbs, well distributed along the upper six or eight inches of the young tree, should be left to form the main framework of the tree. Limbs should be selected that do not form narrow-angled crotches with the trunk since such limbs are easily split off when loaded with fruit.

During the early part of the summer the orchard should be gone over again to rub off sprouts that come out late. This will help to force the growth into the limbs which will ultimately form the main framework of the tree.

Winter Pruning of Year-Old Peach Trees.—During the following winter all surplus limbs which grew late the preceding summer should be cut off. If the frame branches have developed so many side branches that they are likely to fill up the center and make it too dense, some of them should be removed. All cuts should be made close up to the tree, or, where small limbs are headed back, just above a bud, so that no dead snags will appear the following season. From the beginning, the grower should so prune as to keep the top of the tree open (vase shaped), spreading, and low. An open-top tree will permit the sunlight to give

color to the fruit and also help produce fruiting wood low down in the tree.

A spreading top is obtained by cutting off the leaders or main limbs just above a side branch that is growing towards the outside of the tree. In the absence of a branch, the cut should be made just above an outside bud.

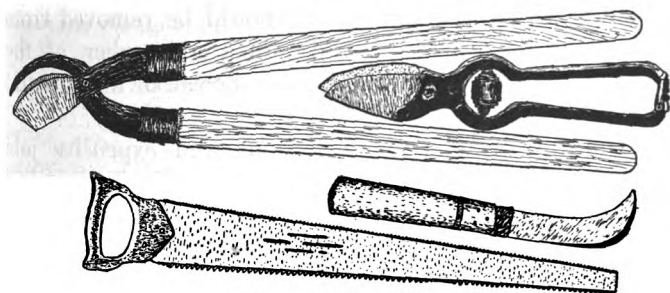
The Second Summer Pruning.—More summer pruning can be done the second year than was advisable the first summer. This is because of the large number of side or secondary branches that will develop the second season, and the crowding of the top that results. The soft, weak shoots in the center of the tree can be rubbed out by hand early in summer if taken in time, and so avoid the necessity of using pruning tools.

The Second Winter Pruning.—Lighter pruning should occur during earlier years of trees' life rather than later years according to present day conception. Heading back the strong, growing limbs should continue and they should be thinned where they are crowded. Continue to prune from the center of the tree, keeping in mind that the tree, when grown, should be shaped like a vase or inverted funnel. Furthermore, the limbs coming out from this low-headed tree should approach a horizontal position so that when heavily loaded with fruit they will tend to bend down and rest their tips on the ground. This relieves a part of the strain, and such limbs break far less often than limbs growing in a decidedly upright position.

The Third Winter Pruning.—After a peach orchard reaches four years of age the framework and general shape of the tree should be well established and the terminal growth much shortened. The top should be

kept thinned out, both to admit the sunshine and to facilitate thorough spraying. A part of the twigs of the preceding summer's growth, which is the fruiting wood of the peach, should be removed in order to thin, to some extent, the coming crop of peaches.

Pruning Bearing Peach Trees.—As the trees grow older, the pruning consists mainly of (1) cutting out broken and diseased limbs, (2) thinning the branches,



PRUNING TOOLS

Two types of shears, a saw, and a knife.

here and there where they become crowded, (3) heading back an occasional limb which is inclined to become high, and (4) cutting out some of the twigs as a partial fruit thinning process.

Where it is necessary to remove large limbs, the work should be done with a saw. The under side of the limb should be sawed first in order to prevent splitting when the limb drops.

Thinning Peaches.—A much better grade of peaches can be grown if the trees are allowed to bear only such number as they can develop properly. The fruit is thinned to some extent when pruning by cutting out a part of the twigs of the preceding summer's growth as suggested in the preceding paragraph. However, the

necessary amount of thinning cannot be accomplished by this method, since no one can tell how many blossoms will be killed by frost in the spring.

The most common method of thinning the fruit is picking off of the peaches by hand in May or soon after the "summer drop." At this time the trees are worked over and the small and poorly developed peaches are picked off. The best developed specimens, spaced about four inches apart on the twigs, are left. The young peaches which are pulled off should be removed from the orchard and destroyed, since a number of the smaller ones may contain eggs or larvae of the curculio beetle.

Thinning peaches is a tedious and expensive job. Consequently, the commercial grower relies a great deal upon proper pruning as a thinning procedure. During good crop years though, it is necessary that certain varieties be thinned in order to obtain good-sized and quality fruit.

Disposal of the Prunings.—Peach prunings are hauled from the orchards and burned in some nearby place where the fire will do no injury to the trees. This is to destroy any San Jose scale or spores of brown rot or leaf curl diseases which may be present on the prunings.

Pruning Tools.—The tools commonly used for pruning a peach orchard are hand shears, lop shears, and a pruning saw. The hand shears are used more than any other one implement, since all limbs within reach of the pruner can be removed with this implement, if they are within a half inch in diameter. The lop shears are used to remove limbs or water sprouts too large to be cut out with the hand shears and too small to necessitate the use of a pruning saw. The pruning

saw is used for the removal of limbs too large to be cut by the lop shears. Limbs with diameters up to an inch or more can be removed with a pair of lop shears.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. When should cultivation of the orchard begin?
2. What are the purposes of cultivation?
3. Do roots require air?
4. Why would you plant intercultural crops in a young orchard?
5. What are cleanly cultivated crops?
6. What crops are grown in young peach orchards?
7. Would you plant corn there? Why?
8. What crops are grown in the orchards near you?
9. What distance should be left between the young trees and the rows of the crop? Why?
10. How should cotton be planted in the orchard the first year? The second year?
11. Should a crop be planted the third year?
12. What cultivation is given a bearing peach orchard in the fall? What implement is used? How set?
13. What time in the spring is a bearing peach orchard cultivated? How do you keep the land level?
14. What method of cultivation do you use on hillside lands?
15. How many cultivations should be given during the summer?
16. Why is it important to cultivate after rains?
17. What implements do you use for cultivating the orchard?
18. Why do commercial growers plant winter cover crops?
19. Why do growers in the Piedmont section use cover crops more than growers in the Coastal Plain section?
20. When is pruning generally done?
21. Why are the trees pruned?

22. In young peach orchards what pruning should be done in the spring? In the summer?
23. Draw a diagram on the board showing how limbs should be left on a young tree.
24. What pruning should be done in the winter following the setting of the trees?
25. Why do you prune for an open top? How do you prune for an open top?
26. What pruning is done the second summer? The second winter?
27. What pruning is done the third winter?
28. What pruning is done to bearing peach trees?
29. How can you thin the fruit by pruning?
30. Why is thinning peaches by hand expensive?
31. At what stage should peaches be thinned?
32. Why does thinning improve peaches?
33. What disposal should be made of peach prunings? Why?
34. What tools are used in pruning?

SUGGESTED EXERCISES

1. Visit nearby peach orchards and study methods of cultivating and pruning and the cover crops used by the orchardists.
2. Bring a small peach tree into the classroom and prune it according to directions given in the text. Any seedling peach tree will serve for this purpose.
3. After the practice in pruning given in the classroom, visit an orchard and prune peach trees of different ages, using the different tools as needed for the job.
4. Select two peach trees of the same variety. Thin the fruit four inches apart on one and leave the other unthinned. Note the differences in size, attacks of diseases, etc., of the fruit of the two trees at harvest time.

CHAPTER VII

PEACHES—CONTROLLING INSECTS AND DISEASES

Job 8—Controlling Insects and Diseases of Peaches

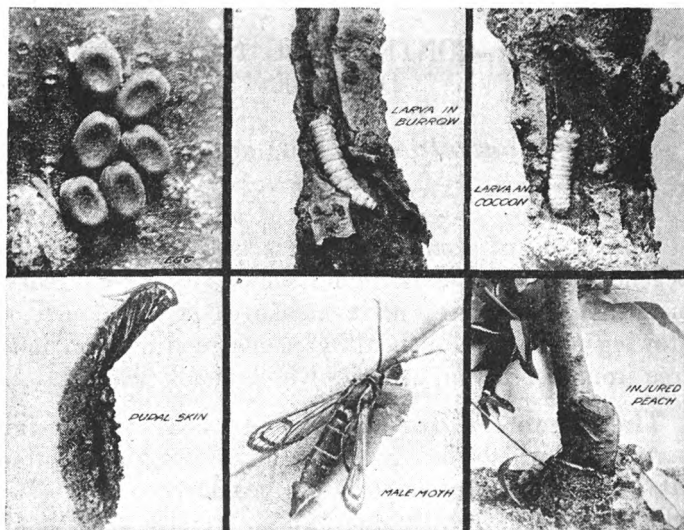
The work of controlling insects and diseases of peaches really begins in the nursery. Here the nurseryman should use preventive measures largely, such as growing and budding healthy peach seedlings on land free from insects and diseases which attack peaches.

The Peachtree Borer.—The first insect pest of importance to which the orchardist must give his attention after planting the orchard is the peachtree borer. The adult borer is a slender moth about the size of an ordinary wasp. The female is dark navy blue, having opaque forewings and a broad orange band around the abdomen. The male moth is somewhat smaller than the female, having transparent wings and narrow yellow bands around the abdomen.

Peach borers are best known and generally recognized by the worms or borers found burrowing in and feeding just under the bark at the base of peach trees.

The insect passes the winter in the larval or "worm" stage. These worms pupate and the adult moths begin coming out in late summer. These moths mate soon after coming out and begin laying eggs in the crevices of the bark of the peach trees usually just at the surface of the ground; however, some may lay eggs up in the crotches of the trees and on the foliage. As the eggs

hatch, the young borers crawl or drop to the base of the tree where they work their way through the bark into the live tissue. Here they feed during the warmer days



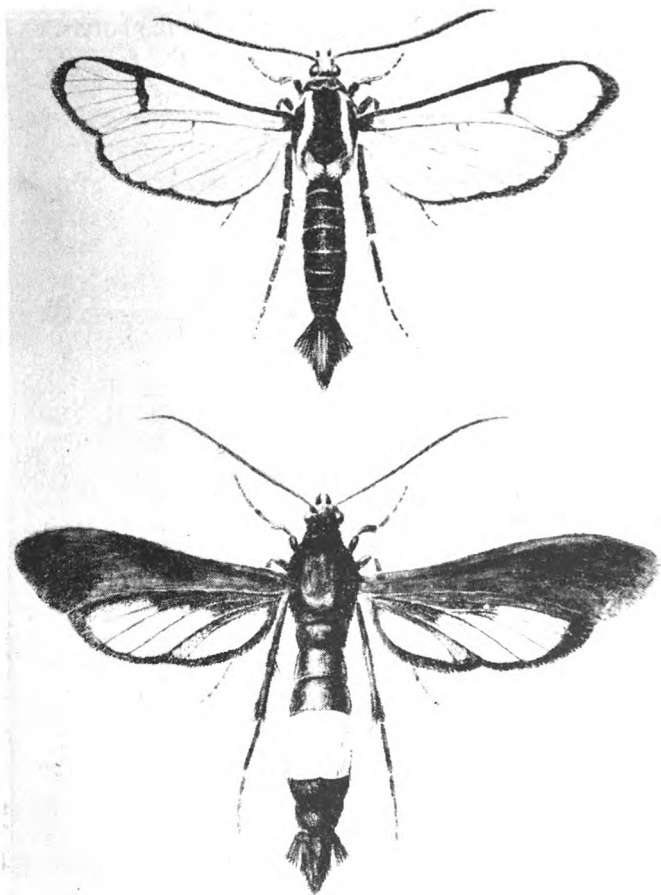
Courtesy of O. I. Snapp

DEVELOPMENTAL STAGES OF THE PEACHTREE BORER

of winter. The following spring they resume active feeding and pupate during the summer.

Worming Young Peach Trees.—Worming peach trees during the late fall was a standard practice in the past to reduce the damage caused by borers during the first few years of the orchard. In recent years it has been found that either ethylene dichloride or paradichlorobenzene emulsions, diluted to recommended strengths, will control peach borers. These materials when correctly used under most conditions cause little, if any, damage to the trees and are decidedly superior to the old system of "worming." They are now becom-

ing generally used and recommended for use in the control of the peach borer in trees less than four years old.



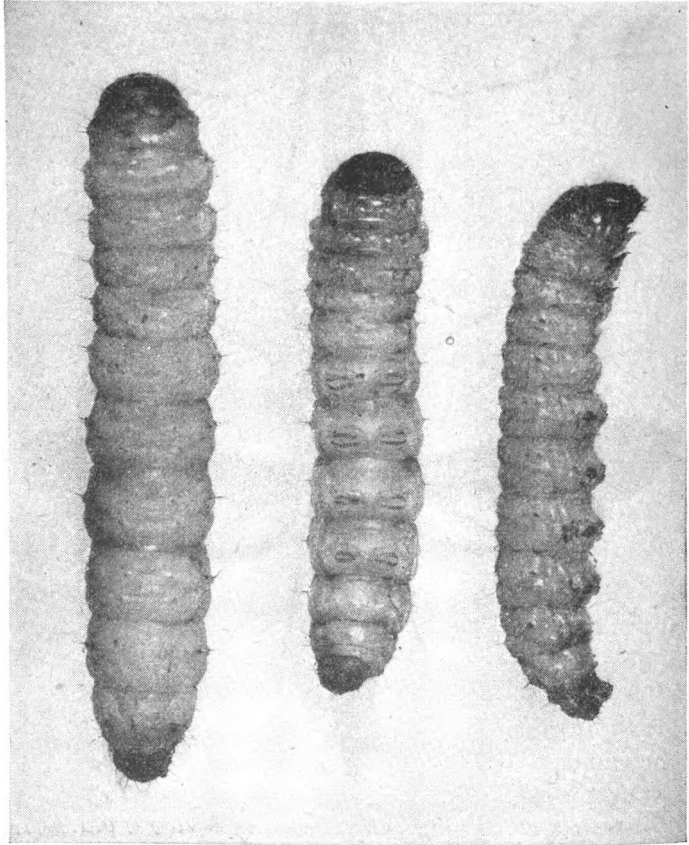
Courtesy of O. I. Snapp

PEACHTREE BORER ADULTS

Top, male moth; bottom, female moth.

Crystalline paradichlorobenzene is still used on older trees, though both emulsions effectively control the peach borer in trees of all ages. Both of these materials give off a gas heavier than air which penetrates the soil and crevices around the trees and kills the borers.

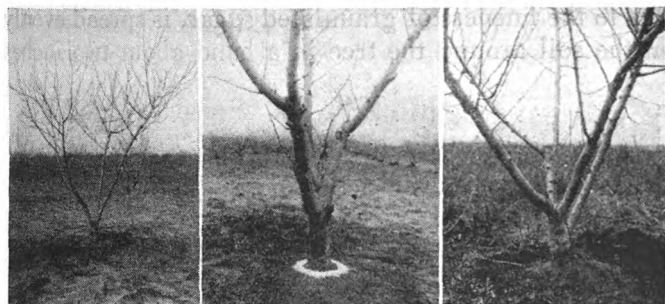
The treatment should be given in the fall after the



Courtesy of O. I. Snapp

LARVAE OF THE PEACHTREE BORER

hot weather passes and before the cold of the winter comes. At this time the soil will be of the proper temperature for the chemical to evaporate and give off gas at the proper rate to kill the borers and do very little



Courtesy of O. I. Snapp

PARADICHLOROBENZENE TREATMENT FOR PEACHTREE BORER CONTROL

Left, soil around peach tree made ready for treatment; *center*, the ring of crystals placed from one to one and one-half inches from the tree trunk; and *right*, several shovelfuls of soil placed on top of the ring of crystals and packed lightly with the back of a shovel.

damage to the trees. Ethylene dichloride emulsion may be used at a lower soil temperature than paradichlorobenzene. Thus the former material may be used later in the year than the latter.

Treatments given during the winter have not proved satisfactory. April 1 treatments give about 75 percent control, but spring treatments are not recommended unless for an unavoidable reason the fall treatment could not be given. By spring the borers have damaged the trees considerably.

Since the gas given off from paradichlorobenzene and ethylene dichloride is heavier than air, the chemical should be placed slightly above the borer attacks at the base of the trees.

If any gum or frass is noted on the tree above the

surface of the soil, the first step is to smooth the soil around the base of the tree, and then the soil should be raised slightly in order to bring it above the level of the frass or gum.

The paradichlorobenzene, which should be pulverized to the fineness of granulated sugar, is spread evenly on the soil around the tree in a band about two inches



Courtesy of O. I. Snapp

**APPLYING ETHYLENE DICHLORIDE EMULSION FOR THE CONTROL OF
THE PEACHTREE BORER**

Note handy household measuring cup with short handle used for this purpose.

wide and one inch from the tree. Soil free of stones, grass, and trash is then placed over this material to the depth of about six inches. The surface of the soil is then packed with the back of the shovel to prevent washing from rains and to confine the gas.

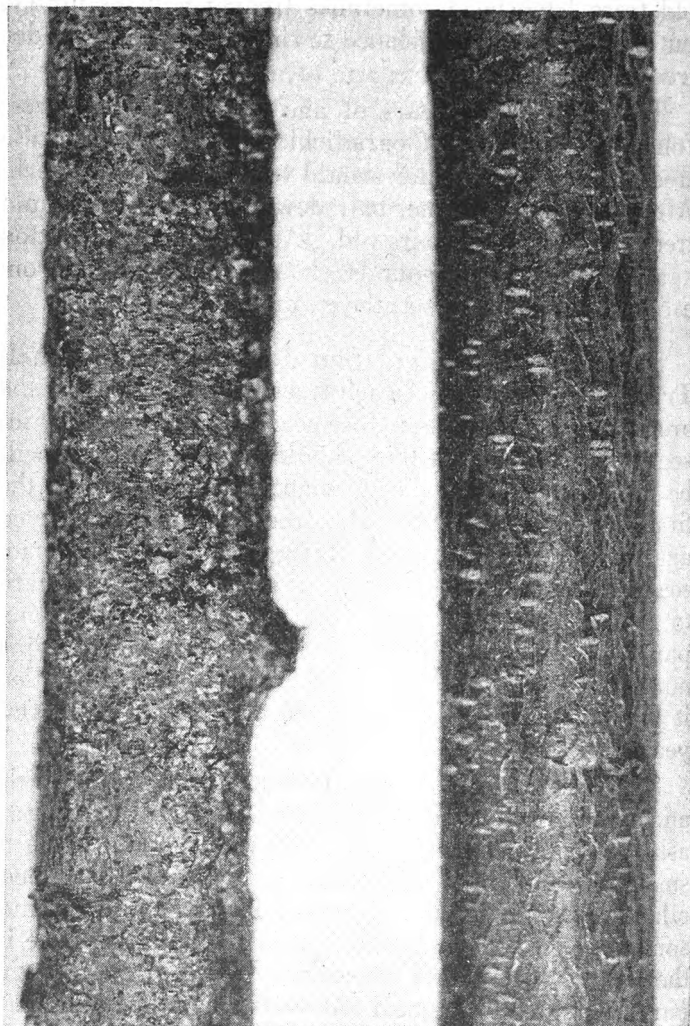
Peach trees four years old and older may be treated with paradichlorobenzene. One-, two-, and three-year-

old trees have been sometimes treated without injury, but they have less resistance to the chemical than older trees.

Trees under six years of age should receive three-fourths of an ounce of paradichlorobenzene each, while trees six years and older should receive one ounce each. After four weeks' time, tear down the mounds around trees four and five years old. As an added precaution against injury the mounds should be removed from around the older trees at the expiration of six weeks.

Spraying to Control San Jose Scale on Peach Trees.—If the young peach trees, when bought for the orchard, are free of San Jose scale, as well as other insects and diseases as they should be, no spraying will be necessary during the dormant season following the first summer's growth. The trees should be sprayed against the San Jose scale during the second dormant season, because no peach grower can expect his orchard to remain free from it very long. It is an insect comparatively easy to control by spraying, but the spraying must be done thoroughly. If the insect is not controlled it will destroy the entire orchard within a very few years.

San Jose scale is an insect which feeds on the bark, and when a tree is heavily infested the limbs present an ashy gray appearance. The individual scale is quite small, little, if any, larger than the point of a lead pencil. This scale is grayish in color, circular in outline, somewhat convex, and with a nipple-like prominence in the center. The insect causes small sunken areas in the bark, which exhibit small red spots when the outer bark is pared down to the live tissue. The scales multiply very rapidly throughout the summer. The young scales, small yellow insects, crawl out from the parent scales,



Courtesy of O. I. Snapp

SAN JOSE SCALE ON PEACH TWIG (*left*) AND PEACH TWIG UNINFESTED (*right*)

and attach themselves to new growth and fruit. Here they remain and grow or form scales which cover their bodies. This small yellow body can be observed at any time by raising up the scale by means of a needle or the point of a knife.

The San Jose scale is so resistant to sprays that it is necessary to spray the trees during the dormant season in order to use a spray concentrated enough to kill the scale without injuring the trees.

This insect can be killed by spraying the trees with either concentrated lime-sulphur mixture or with lubricating oil emulsion.

Where the trees are heavily infested it is best to spray the trees twice; once after a killing frost has occurred in the fall, and again just before the trees blossom in the spring. The spraying given in the early spring will aid in preventing the leaf curl disease as well as destroy the scale.

A number of reliable manufacturers are now making sprays, both the concentrated lime-sulphur mixtures and the oil emulsion, which, if used according to directions, are effective against the San Jose scale.

Oil Emulsion Sprays.—In making oil emulsion sprays a lubricating oil, commonly known as red engine oil, is used. Two common materials used to emulsify or make the oil mix with water are potash fish oil soap and calcium caseinate, which is a product from dried milk. These can be mixed in tubs or barrels. The proportions are as follows:

FORMULA 1

Red engine oil	2 gals.
Potash fish oil soap	2 lbs.
Water	1 gal.

FORMULA 2

Red engine oil	2 gals.
Calcium caseinate	6 ozs.
Water	1 gal.

In the first formula the mixture is heated to the boiling point in a pot or by passing live steam from a boiler into the mixture in a barrel. When live steam is passed directly into the mixture allowance must be made in the formula for the water accumulated from the condensed steam. In the second formula the ingredients may be mixed cold.

In both cases the ingredients are thoroughly mixed and put into a spray tank to be pumped through the spray nozzles into another receptacle, three times, under 100 pounds or more of pressure. In using Formula 2 the calcium caseinate must be thoroughly mixed with the water before the oil is added. Four and one-half gallons of either of the above mixtures may be mixed with $95\frac{1}{2}$ gallons of water to make 100 gallons of spray for spraying peach trees against the San Jose scale in winter or during the dormant season.

Where the mixture, made by either formula, is allowed to freeze or stand until the oil separates from the other materials, it will be necessary to reheat or remix and pump from one vessel into another just as was done at the beginning.

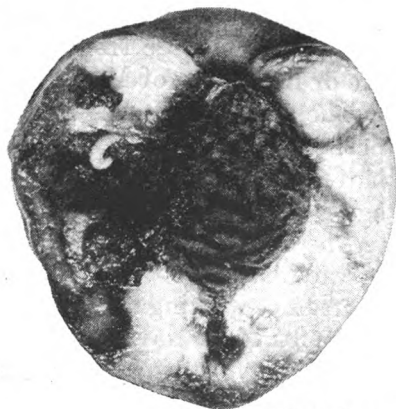
Kind of Spray Outfit to Use.—A barrel pump, operated by hand, may be used for spraying small orchards against San Jose scale, but a power outfit, as described for applying summer sprays, is necessary for commercial peach orchards.

Peach Leaf Curl Disease.—The fungus causing leaf curl disease lives over winter on the buds and small twigs of the peach tree, and attacks the young leaves as

they unfold in the spring. The leaves turn yellow, often with a reddish tinge, finally a pale green, and then become almost white. They become very thick or distorted with wrinkled and folded edges. After a few weeks the diseased leaves fall to the ground.

The lime-sulphur mixture given a peach orchard to control the San Jose scale will hold the leaf curl disease in check. If oil emulsion is used for scale control, bordeaux mixture, 4-5-50, must be added if leaf curl is prevented. Where it becomes necessary to spray for this disease alone, an application of concentrated lime-sulphur mixture, of the same strength as for San Jose scale, given in the early spring just as the fruit buds show signs of swelling will usually be sufficient.

Controlling Plum Curculio, Brown Rot, and Scab of Peaches.—The next important job of controlling insects and diseases of peaches comes when the trees reach the bearing age. Plum curculio, which is a small beetle, and brown rot and scab, two fungus diseases, all attack the fruit of the peach. Often a single spray mixture can be used towards the control of all these peach troubles at one time.



Courtesy of O. I. Snapp

PLUM CURCULIO LARVAE OR "WORM"
IN PEACH

Plum Curculio.—

The plum curculio, which causes worms in peaches, is rated as the most harmful insect pest attacking peaches

in the South at the present. It also attacks plums, apples, and cherries. The curculio has four stages of development in common with other beetles—egg, larval, pupal, and adult.

The adult is a small, grayish, black or brown-snouted beetle, with a hump on its back, which measures about three-sixteenths of an inch in length. This beetle is the parent of the cream-colored grub or "worm" found in small green peaches which have dropped to the ground. In peaches which are ripening it is found near the seed.

The curculio passes the winter in the adult or beetle stage in tufts of grass and under straw, leaves, or other rubbish in woods and on ditch banks near the orchard.

These beetles come out from winter quarters in the early spring as the peach trees begin to blossom. They feed first on the calyces of the peach flowers and the new leafy growth as it comes out, and later on the small fruit. All the beetles do not come out at one time. They continue to emerge from winter quarters until the middle or latter part of May.

The beetle punctures the skin of the young peach, deposits an egg in the cavity, and then makes a crescent or half-moon shaped cut over the punctures containing the egg.

The egg hatches three to six days later and the young larvae eat their way into the peaches. The young peaches containing the worms usually fall to the ground. From 16 to 18 days after the eggs hatch the worms or larvae reach full size, leave the fallen peaches, and burrow into the soil from two to three inches below the surface where they change into the pupal stage in a small earthen cell.

About 12 days later these pupae change into adult beetles which come out of the ground and begin to feed on the foliage and fruit of the trees.

Usually these beetles, as well as the remaining ones which lived over winter, puncture and lay eggs in the fruit of the midseason and late varieties of peaches. This gives a second generation or crop of "worms" in the fruit of such varieties as the Elberta and Hale at harvest time.

How to Control the Curculio.—The curculio is controlled (1) by sanitary measures such as cleaning up all trash or rubbish in the orchard, burning off and cleaning up terraces and ditch banks, and burning off strips of woods 200 to 300 yards wide near the orchard for the purpose of destroying adult beetles in their winter quarters; (2) by cultivating frequently during the spring and early summer to destroy the insects in their pupal stage in earthen cells in the soil; (3) by picking up and destroying all peaches that drop from the tree, especially in April and early May, to kill the worms in them; and (4) by spraying the trees with arsenate of lead to poison the beetles.

Brown Rot of Peaches.—Brown rot is possibly the worst disease the peach grower has to fight. It is caused by a fungus which lives over winter in cankers or diseased spots on the limbs of peach trees, and on the dried or mummied peaches which have decayed and remain hanging on the tree or have fallen to the ground.

When the weather becomes warm in the spring, the fungus develops spores which are capable of infecting and destroying the peaches.

Brown rot may attack uninjured peaches; however, infection usually takes place through punctures made by the plum curculio or through small cracks caused by the scab disease.

The first step in the control of brown rot, as for most other orchard diseases, is orchard sanitation. That is,

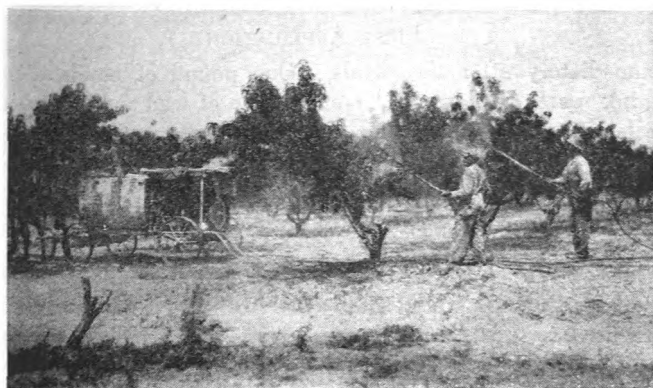
cleaning up and destroying all diseased fruit, and pruning out and destroying diseased limbs and twigs.



BROWN ROT ON PEACHES, SHOWING SPORE-TUFTS, OR "MOLD"

The main reliance is to have the fruit properly sprayed before it ripens. The disease is found on other fruit, and is almost always present, even where the orchard has been well cleaned, necessitating spraying along with other preventive measures.

Scab.—Peach scab is caused by a fungus which attacks the leaves, twigs, and fruit of the tree. It lives over winter in spots on the twigs and cannot be destroyed by winter sprays for the reason that it grows just under the cuticle or outer bark covering the twigs.



Courtesy of O. I. Snapp

SPRAYING PEACH TREES

During warm, rainy weather of early spring and summer the fungi of these diseased spots produce spores or small reproductive bodies, which are carried by drops of water to the young fruit where they grow and infect the fruit.

Scab produces sooty, black specks on the fruit, leaves, and twigs of the peach tree. These specks often become so numerous that they give the fruit a rusty, black color, cause it to crack, and fail to ripen normally. The spores

of the brown-rot disease often enter the peach through these small cracks and do further damage.

To protect the fruit it is necessary to have it coated with a spray when the spores of the disease are produced, which occurs from April throughout the summer.

Spraying to Control Plum Curculio, Brown Rot, and Scab of Peaches.—Spraying for the control of the curculio, brown rot, and scab of peaches is done during the spring and summer. The following spray schedule to aid in the control of peach insects and diseases is recommended:

FIRST APPLICATION

Immediately after the petals (pink part of flower) have fallen.	One pound of powdered arsenate of lead and lime water from three pounds of hydrated lime to each 50 gallons of water.
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SECOND APPLICATION

When calyces or "shucks" are shedding, or when small peaches are exposed.	One pound powdered arsenate of lead and lime water from three pounds of hydrated lime to each 50 gallons of water.
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THIRD APPLICATION

Two weeks after the second application, or about four weeks after the petals have been shed.	Self-boiled lime-sulphur, 8-8-50 (no arsenate of lead in this application).
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FOURTH APPLICATION

Four weeks before each variety is due to ripen.	One pound powdered arsenate of lead to each 50 gallons of 8-8-50 self-boiled lime-sulphur.
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Early Varieties: These should be sprayed three times. Use materials recommended for dormant, petal fall, and shuck split application, and spray one month before ripening.

Preparing Spray Mixtures.—Self-Boiled Lime-Sulphur Mixture: This material may be used in place of flotation or similar sulphurs. It is composed of eight pounds of a good grade of hydrated lime, eight pounds of finely ground flour of sulphur, and 50 gallons of water. Make the sulphur into a thin, soupy paste with water and add the lime to the mixture. More water is added gradually and the mixture stirred slowly as the lime slakes. Care is taken not to allow the mixture to become too dry on the one hand, and not to "drown" the lime on the other.

Use the same precautions that the builder does in slaking lime.

The heat of the lime cooks the mixture. It should be made up to 50 gallons with cold water as soon as the lime is thoroughly slaked or the solution may become so strong as to injure the leaves of the tree.

The solution is now thoroughly stirred and strained into the spray tank ready to be applied to the trees.

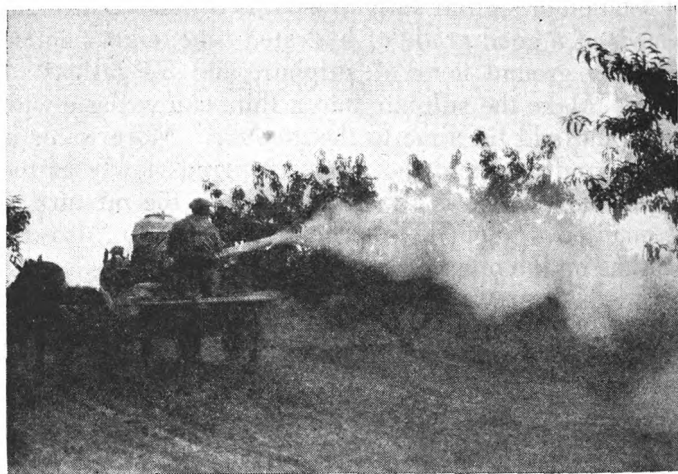
Where the spray schedule calls for arsenate of lead and self-boiled lime-sulphur solution, one pound of powdered arsenate of lead is made into a thin paste with water and stirred into the 50 gallons of lime-sulphur mixture.

Machinery for Dusting and Spraying Peaches.

—Liquid sprays are usually applied to peach trees by use of a power sprayer having a capacity of 300 or more gallons. These power sprayers are either mule-drawn or tractor-drawn, and the spray pump is either powered by a small gasoline engine or makes use of the tractor power with a power take-off attachment. The power-

take-off type of sprayer is becoming increasingly popular with the modern peach grower.

Some orchardists follow the practice of driving along every "middle" or between each two rows of trees, spraying only half of each tree and completing it as the



Courtesy of O. I. Snapp

DUSTING PEACH TREES

spray rig comes back on the next "middle." However, the best practice is to go down every other middle, completing each tree before moving to the next. This insures a more thorough job.

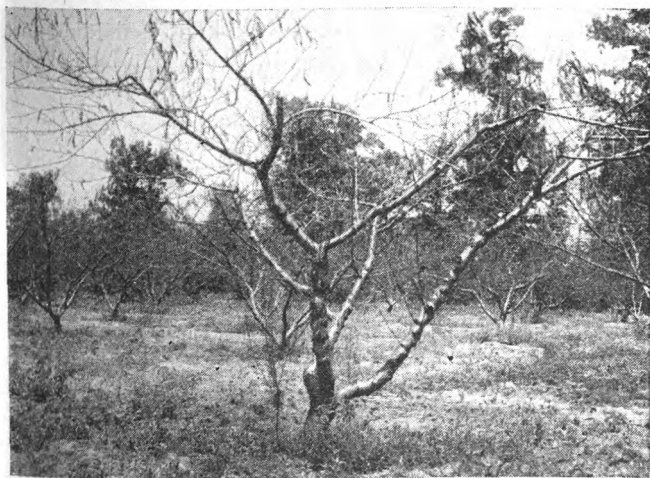
Hand Outfits.—Barrel pumps and other small outfits may be placed on a wagon and operated by hand. These outfits are suitable for spraying home orchards and other small areas of trees, but are not suitable for large commercial orchards.

Dusting Machines.—A number of machines for dusting peaches are now on the market. The dust mix-

ture is placed in a hopper connected with a rapidly revolving fan which blows the dust out through a hose. The fan is run by a small gasoline engine which sends the dust out with considerable force. When the wind is not blowing it is possible to dust the second row of peach trees from the machine, but thorough work is usually not accomplished at this distance. Dusting should not be depended upon as the sole means of insect and disease control. It is to be regarded only as a practice to supplement spraying in case of emergencies or in case of special dusts suggested in the spray schedule.

Other Organisms Attacking the Peach.—Some other insects and diseases of the peach needing the attention of the grower are Oriental fruit moth, root knot nematode, and crown gall.

Oriental Fruit Moth.—The peach orchards of the



Courtesy of O. I. Snapp

PEACH TREES INJURED BY USING A SUMMER SPRAY WHICH WAS TOO STRONG

South have been invaded by an insect known as the Oriental fruit moth. This insect was introduced into this country from Asia about 1914, on some nursery trees.

The adult is a blackish-brown or purple moth which lays its eggs on the under surface of the peach leaves. When the eggs hatch, the larvae bore into the tender growth and kill the tips of the twigs. The larvae also bore into the peaches during the ripening stage and do considerable damage.

How to Control the Oriental Fruit Moth.—

Spraying is of little or no value in the control of Oriental fruit moth due to the peculiar habit of this insect's ejecting the first mouthful in its feeding. Thus, it avoids stomach poisons. In recent years the control has been largely by biological means. The breeding and liberation of parasites which prey on this insect has brought it under commercial control.

Root-Knot Nematode.—Root-knot nematode is a microscopic worm which lives in the soil and attacks the roots of a large number of species of plants.

The roots of peach trees are very susceptible to the attacks of this parasite, especially when grown in deep, sandy soils.

When the land once becomes infested the nematode breeds very fast. One female worm may lay as many as 400 or 500 eggs. These eggs hatch and the young worms reach maturity in from four to five weeks, if the soil and temperature are favorable to their growth. In the warmer sections of the South there may be more than half a dozen generations of the nematode in one year, which shows the rapidity with which the soil becomes infested.

The nematode worm, having a pointed head, can easily penetrate the tips of tender growing roots where

it lives on the new tissue. The roots, in trying to overgrow the injury caused by these microscopic worms, form knots at the points attacked.

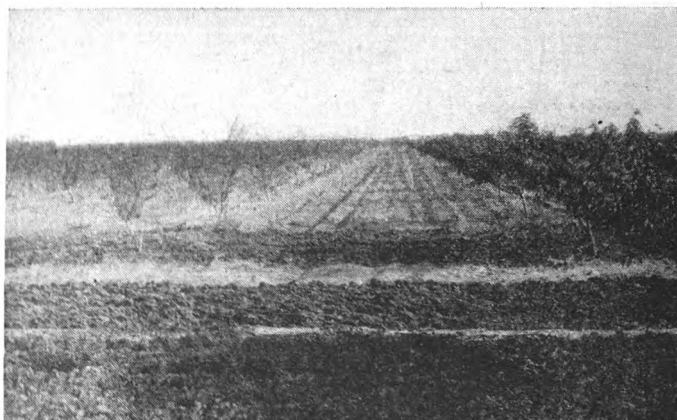


PEACH ROSETTE

When rosette is found the diseased tree should be destroyed at once as there is no cure and it is likely to spread.

Sterilizing the soil with chemicals, as formaldehyde, and with steam has been found feasible for hotbeds and greenhouse benches. However, these methods of treatment do not apply to the open field or peach orchard.

Most species of plums, especially the Marianna plum,



ALL PEACH TREES REQUIRE COLD WEATHER TO BREAK THE WINTER REST PERIOD

Some varieties may require 1,000 hours during one winter with the thermometer below 45 degrees. Note Hileys (*right*) with rest period broken and Mayflowers (*left*) with rest period not broken.



WINTER INJURY TO PEACH TREES

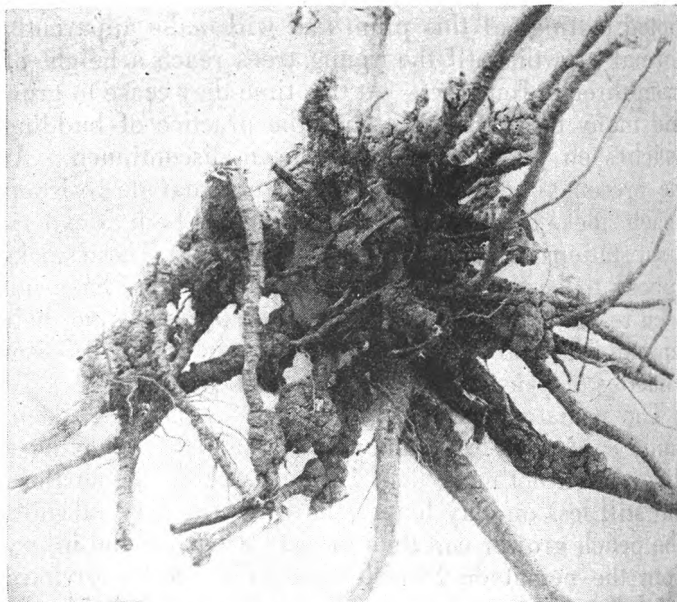
are resistant to the nematode. In a search for resistant seedlings on which the peach may be budded, the Marianna plum at one time gave promise of good results. The peach can be budded on the seedling or rooted cuttings of this plum and will make apparently normal growth until the young trees reach a height of from three to four feet. At this time they cease to grow and many die outright. Thus the practice of budding peaches on plums has largely been discontinued. At the present time Shalil and Yunnan nematode resistant peach stocks are being extensively tested both at experiment stations and in commercial orchards. These stocks appear to be very promising but so far they have not been tested over a wide enough area to determine their adaptability and their effect on the response of different varieties of peaches.

The nematode attacks peaches severely on a deep, sandy soil, does less damage on a sandy soil having a clay subsoil not more than 12 inches below the surface, and still less on clay loam soils with stiff clay subsoils. The peach grower can thus prevent a part of the injury from the nematode by selecting soils for his orchard which have a clay subsoil, and possibly some clay in the loam forming the surface soil. He should avoid deep sandy soils.

Peach trees should not be set on soil infested with the nematode. Then great care should be taken not to plant trees with infested roots. Another important matter is to grow crops resistant to the nematode between the tree rows, especially in an orchard set on sandy land.

Some of the plants more or less resistant to the nematode are onions; Iron, Brabham conch, and Victor cowpeas; all velvet beans; Biloxi, Laredo and O-too-tan soybeans; all varieties of peanuts; practically all grains, as wheat, oats, rye and corn; and practically all grasses.

Crown Gall of Peaches.—Crown gall, which is a bacterial disease, attacks peaches as well as several other fruit trees.



PEACH TREE ROOTS BADLY DISEASED WITH CROWN GALL

The disease produces tumor-like formations on the roots and crowns of peach trees. It may cause the roots to branch and become very fibrous. This type of the disease is called hairy root.

The disease works mostly under ground and lives in the tissue in such a way that no curative measures have been found effective. The grower must rely, therefore, upon methods of preventing the disease from coming into his orchard. Lands which have recently been occupied by an orchard should not be reset to trees for a period of less than three years.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Where should control of peach insects begin?
2. Give the life history of the peachtree borer.
3. Where does the insect lay its eggs?
4. When and how do the borers enter the tree?
5. When are the peach trees wormed for the first time?
6. When are the peach trees in the orchards in your community wormed and at what age?
7. What material for borer control is used in your community?
8. When are peach trees wormed the second time?
9. What is paradichlorobenzene? Ethylene dichloride? How do they kill the peachtree borer?
10. When is paradichlorobenzene applied to peach trees? How is it applied and how much is used for trees of different ages?
11. How is the San Jose scale controlled? How widespread are its attacks?
12. When do you spray peach trees against the San Jose scale?
13. How would you identify the San Jose scale?
14. How does it spread from one part of the tree to another?
15. What sprays are used for killing the San Jose scale?
16. Where would you obtain these sprays?
17. Tell how you would make concentrated lime-sulphur mixture at home.
18. Tell how you would make oil emulsion sprays.
19. What kind of a spray outfit would you use in applying these sprays to the trees?
20. How does the peach leaf curl disease attack the tree and how is it controlled? Name one insect and two diseases troublesome in a peach orchard after the trees reach the bearing age?
21. Which insect commonly causes worms in peaches?
22. How does the curculio compare with other peach insects in the seriousness of its attacks?

23. How would you identify the adult of the curculio?
24. Where do the curculio beetles spend the winter?
25. When does the curculio come out of winter quarters and upon what does it feed?
26. Where does the curculio lay its eggs and how long does it take these eggs to hatch?
27. Where and how does the curculio change into the pupal stage?
28. Name the four methods by which the curculio is controlled.
29. What is brown rot of peaches?
30. How does brown rot pass the winter and how does it attack the trees?
31. How does brown rot spread?
32. How is the brown rot disease of peaches controlled?
33. What is peach scab and how does it attack the trees?
34. How does peach scab spread?
35. How is peach scab controlled?
36. Give a spray schedule for controlling the curculio, brown rot, and scab of peaches.
37. When and how would you spray the trees the first time? Second? Third? Fourth?
38. How would you prepare arsenate of lead, lime, and water mixture for spraying peach trees?
39. How would you make self-boiled lime-sulphur mixture? For what is it used?
40. What kind of a spray outfit is necessary for a commercial orchard?
41. What outfit is used for the home orchard?
42. How does the Oriental fruit moth attack the trees and how is it controlled?
43. What is root-knot nematode and how does it attack peach trees?
44. What is the chief method of controlling the nematode?
45. In what type of soil is the nematode most severe?
46. How does crown gall attack peach trees and how is it controlled?

SUGGESTED EXERCISES

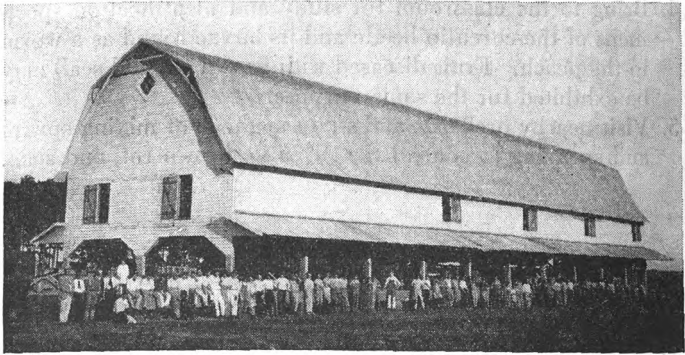
1. Visit nearby orchards and study the orchardists' methods of controlling insects and diseases.
2. Bring for classroom study small peach trees attacked by borers and San Jose scale. This material is usually plentiful in neglected home orchards. From these learn to identify the San Jose scale and the larvae of the peachtree borer.
3. Secure small quantities of the necessary materials from spray manufacturers and make up mixtures of lime and sulphur, miscible oils, and oil emulsion sprays for controlling the San Jose scale.
4. Bring to the classroom for study and identification specimens of the curculio beetle and its larvae found as a worm in the peach. Fruit diseased with brown rot and scab may be exhibited for the same purpose.
5. Visit nearby orchards and study methods of mixing sprays and spraying to control the curculio, brown rot, and scab.

CHAPTER VIII

PEACHES—PICKING AND MARKETING

Job 9—Marketing Peaches

The marketing of peaches successfully depends upon (1) having good fruit, (2) careful picking and uniform grading, (3) good packing in attractive packages, and



Courtesy of O. I. Snapp

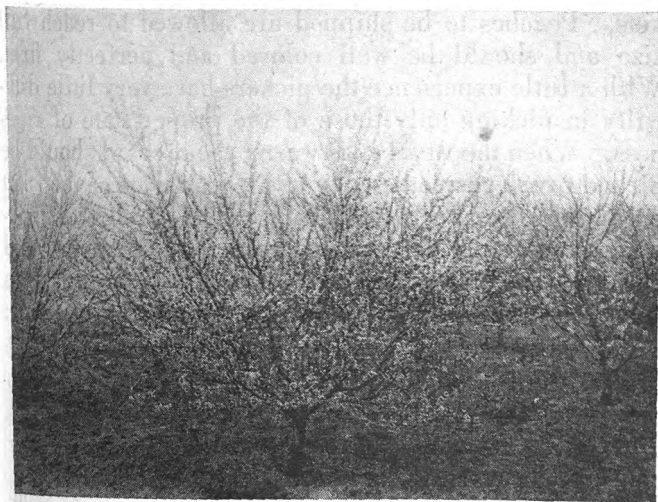
COMMERCIAL PEACH PACKING HOUSE

(4) proper selection of marketing agencies or good salesmanship.

Preparations for marketing should begin while the peaches are being grown. Baskets, tops, and liners for harvesting and shipping the crop of peaches should be bought and stored ready for use when needed. Extra labor for picking and packing the fruit should be engaged ahead of time, for peaches must be handled quickly and at the proper time.

Picking Peaches.—Unskilled labor may be used for picking peaches. An experienced foreman can direct from 20 to 30 pickers and see that they pick the peaches at the proper stage of ripeness. It requires about 25 pickers to pick over 65 acres of peaches every 3 days.

Double-decked wagons, that is, wagons with frames



FOUR-YEAR-OLD PEACH ORCHARD IN FULL BLOOM

or bodies so constructed that two tiers of baskets can be hauled without the upper baskets mashing the fruit in the lower baskets, are used for hauling the peaches from the orchard to the packing house. These wagons are driven along through the orchard and receive the baskets of peaches from the pickers. Baskets holding one-half bushel are used for this purpose. Peaches are never poured from one basket to another in the orchard. As the baskets are filled they are set on the wagon. When the wagon is loaded it is driven to the packing

shed and the load turned over to the graders and packers. The wagon is then reloaded with empty baskets which are carried to the pickers in the orchard as the wagon returns for another load of peaches.

The Proper State of Ripeness for Picking.—

Peaches for the local market are allowed to become riper on the trees than those to be shipped to distant markets. Peaches to be shipped are allowed to reach full size and should be well colored and perfectly firm. With a little experience the pickers have very little difficulty in picking only those of the proper state of ripeness. When the weather is warm, the orchard should be picked over every other day to prevent some of the fruit becoming too ripe for shipping. The number of pickings necessary in one season varies with the variety and with the weather conditions. From four to five pickings are about the average number for commercial orchards.

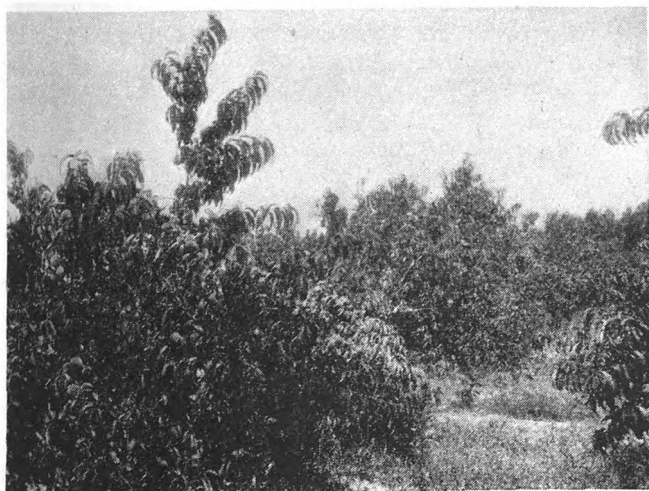
Where the fruit is to be sold on the local market for immediate consumption it may be allowed to remain on the trees until just before it begins to soften. Peaches allowed to ripen on the trees are of a much better quality than when picked before fully ripe.

Grading and Packing Peaches.—Commercial peach growers often employ an experienced peach packer who takes the responsibility of securing the necessary number of packers and supervising the packing of the peaches. This man is generally spoken of as the "shed boss."

Orange packers frequently pack peaches also. They begin in the southern part of the peach belt where the peaches ripen first and move northward from orchard to orchard as the peaches ripen. When the peach season is over they have sufficient time for returning to Florida

to be in readiness for the orange shipping season which comes later.

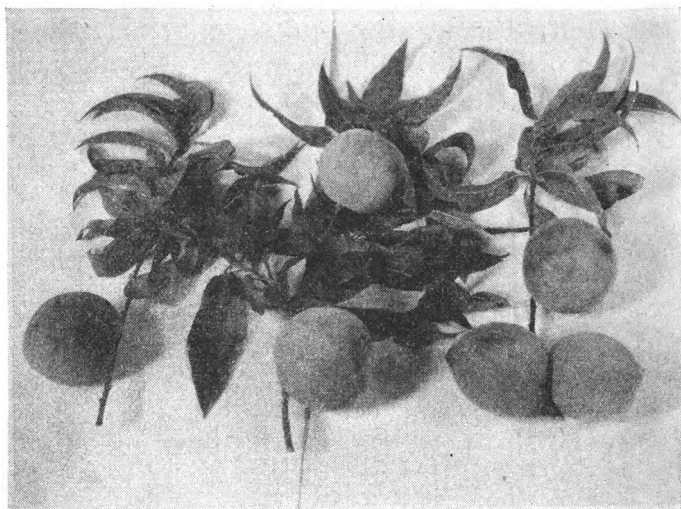
Peach packers are paid about the same wages as other skilled laborers. A good packer will pack from 100 to 125 bushel baskets and from 175 to 200 half-bushel



BEARING PEACH ORCHARD

baskets in a day. Each basket packed is inspected before the cover is nailed on. If the basket contains peaches with insect punctures or decayed specks, green or over-ripe peaches, the basket is rejected and the packer has to pack it over again. Each packer is given a number. He places a check or ticket containing his number on top of every basket he packs. By these numbers the inspector can trace a basket back to the one who packed it. Where the packers work by the basket, these numbers are used as records of the number of baskets packed by the different packers.

Types of Graders for Peaches.—Growers having large volumes of peaches to handle frequently install sizing machines run by a gasoline engine or an electric motor. These sizers do the work very rapidly and grade according to size of fruit. They provide an opportunity



Courtesy of G. C. Starcher

WELL DEVELOPED PEACHES ON TWIGS SHOWING METHOD OF SPACING

for sorting out the peaches with decayed spots or with insect punctures before going on to the sizing devices.

A very good labor organization for a 65 acre peach orchard is composed of 25 pickers in the orchard, 7 graders, and 7 packers, with the necessary help for getting the fruit from the orchard to the packing shed and for loading the cars after the crates are packed.

Packages for Shipping Peaches.—Peaches from southern orchards are generally shipped in either bushel or half-bushel tub baskets. A decade ago the Georgia

crate carrier was most popular but its popularity is on the wane because the baskets may be much more easily, rapidly, and cheaply packed. The low prices paid for peaches during the last few years do not justify the added expense caused by the use of the carrier. The tub basket offers a number of advantages over the other carriers as they (1) cost about one-third less than crates; (2) require less careful packing; (3) hold about one gallon more than crates and can be packed very rapidly, enabling the grower to dispose of his crop quickly; and (4) can be more rapidly and easily placed in the cars for shipping.

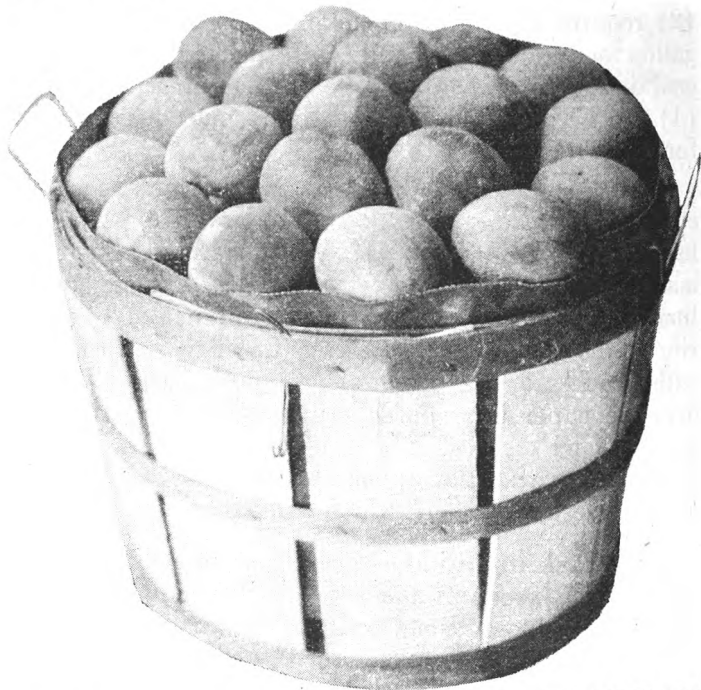
When packing in baskets, a "ringer" or "facer" is employed which enables the packer to arrange the top layer of peaches or the "face" in a neat and systematic manner. When the face is completed a heavy paper liner of the same depth and circumference of the interior of the basket is slipped over it. This is then filled with peaches to the proper level and a basket slipped over the paper liner until the edge is flush against the metal facer; the basket is then inverted. This method greatly improves the appearance of the package and also insures a tight pack which will carry well.

The Packing Shed.—For a commercial orchard, the packing shed or house is constructed two stories high. The side and end walls of the first story, where the packing is done, are left open to admit light and air. The upper story is walled in and used for storing baskets, crates, and other material which is bought and stored ahead of the harvest season.

The first floor of the packing shed should be on a level with the wagon or truck beds to facilitate unloading the peaches from the orchard. This also facilitates loading the packed crates or baskets back into the wagons where

they are to be hauled to the railroad station. This height is also convenient for loading the cars in case the packing shed is built on a railroad siding.

Size of the Packing Shed.—The size of the packing shed necessarily varies with the volume of the peaches to be handled daily and the method of packing



Courtesy of G. C. Starcher

HALF BUSHEL OF PEACHES READY TO BE CAPPED FOR SHIPPING

employed. It is better to have some surplus space than to have the workers crowded.

A shed 60 feet long and 30 feet wide should be large enough to pack in crates a maximum crop of peaches

from a 65 acre Elberta orchard. Some growers have a shelter built on the side of the shed to drive under when the wagons are being unloaded.

The number and arrangement of the packing tables as well as the division of labor, as numbers of graders, packers, etc., in a packing shed is a job for the "shed boss." These items change frequently in order to keep the work running smoothly.

How Peaches Are Shipped.—The three common methods of shipping peaches are (1) shipping small lots by express, (2) shipping by carlots in refrigerator cars, and (3) shipping by truck.

Peaches are shipped by express only where the lots to be shipped are too small to ship in carlots. Express shipments are usually delivered promptly; however, express charges are considerably higher than freight charges.

Shipping in Refrigerator Cars.—Almost all the peaches from large, commercial orchards are shipped to the markets in refrigerator cars. These cars are especially constructed to ship perishable products long distances at low temperatures. These cars have a bin or compartment at each end which is filled with ice before the peaches are loaded. They are re-iced as often as necessary between the orchard and their destination after they are loaded with peaches. Railroad companies maintain icing stations along the routes for this purpose.

How the Cars Are Loaded with Bushel Baskets.—Refrigerator cars vary in size. However, a car with an inside measurement of 8 feet and 4 inches wide, and 33 feet long is the standard size.

Bushel baskets are placed three deep in the cars. They are held in place by slipping the ends of the cross-

arms on the lids into the handles of the adjacent baskets. No strips of lumber are necessary for holding the baskets in position, thus enabling the grower to load the cars much faster. A car will hold 387 bushel baskets or 774 one-half bushel baskets.

Shipping in Trucks.—With the mechanical improvement of trucks and the development of better highways, there has been a decided increase in the shipment of peaches to market by truck. The truck has the advantage that it comes right to the orchard and picks up the fruit saving the grower and his help much time. It makes possible a wider choice of market, is a boon to the smaller grower in that smaller than carload shipments are accepted, offers new opportunities to growers in areas lacking other means of transportation, and has widened and increased the consumption of fruits and vegetables in areas of low population which were not reached by previous methods of transportation. Trucks are now equipped with refrigeration and have a hauling capacity about equal to that of one freight car.

Trucks have several disadvantages in that they are more subject to delay since bad weather affects trucks more adversely and collisions, mishaps, and breakdowns are more frequent than with other types of transportation. The greatest single disadvantage is that the great daily variation in truck shipments and the practical impossibility of forecasting the daily supply in terminal markets before trading begins has resulted in lower prices to growers. There is probably little doubt also that truck transportation has slowed up the development of cooperative effort on the part of growers which again generally means lower prices to them.

Methods of Marketing Peaches.—Some common methods of selling peaches are (1) selling for future

deliveries, (2) selling for cash as the peaches are harvested, (3) consigning the shipments to commission houses, and (4) selling through cooperative marketing associations.

If a large number of the growers sell for future de-



GEORGIA PEACHES READY TO BE SHIPPED TO THE FRESH MARKET
They are carefully packed in bushel baskets. The baskets are stacked five-high and kept in the shade.

livery it gives speculators in the peach market a chance to contract for enough peaches for their pressing needs and then bring their influences to bear on holding down prices in order to get the remainder of the crop at a reduced price. From the standpoint of the individual grower, if he sells for future delivery when his crop can be fairly well estimated, he has a rather definite idea as to the amount of funds he will have for his farm operations, and can plan his work accordingly. Sales for future delivery are sometimes made in mid-winter, but they are usually made in early summer after the size of the crop can be estimated.

The grower who sells for cash has the use of his money immediately. The cash buyer must be reason-

ably certain of a wide margin of profit to justify him in paying cash for peaches and taking the risk of getting them to distant markets which may be glutted at the time of the fruit's arrival.

In consigning shipments of peaches to commission houses there is some risk also of the market being glutted. The commission house sells the peaches for the grower and charges him a commission of about five percent of the gross sales. There is often suspicion of unfair dealings on the part of the commission men, but there is very little dishonesty on the part of well-established commission houses. They naturally try to serve their patrons, but often can do little for the shipper in the face of a glutted market. The chief trouble is in the system, for peach growers shipping independently are liable unknowingly to starve one market and glut another. There should be some marketing agency or association which can properly distribute the fruit so as to get a fair price for all the growers and sell the peaches at a fair price to all the consumers.

Selling Peaches Through Cooperative Marketing Associations.—A cooperative marketing association is organized by the growers to market their commodities collectively, and thereby secure a part of the money that they would otherwise have to pay marketing agents. Non-profit cooperative marketing associations are now organized in the different sections of the country for selling all our principle farm products, including fruit.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Upon what four factors does the successful marketing of peaches depend?

2. When should preparation for marketing begin?
3. What type of labor is used for packing peaches?
4. How long will it require 25 pickers to pick over a 65-acre peach orchard?
5. What type wagons are used for hauling the peaches from the orchard?
6. Into what size baskets are the peaches picked?
7. Should peaches ever be poured from one basket to another in the orchard?
8. How are the empty baskets carried from the packing shed to the orchard?
9. At what stage of ripeness should the peaches be picked for the home market? For shipping to distant markets?
10. How often should the peaches be picked from the orchards?
11. How many pickings are necessary in one season?
12. When should the fruit be allowed to ripen on the tree?
13. How is the packing of peaches supervised in the packing shed?
14. What wages are paid peach packers?
15. How are numbers used to keep records of peaches packed by different packers?
16. How are peaches graded?
17. How many pickers, graders, and packers are necessary for a 65-acre orchard?
18. Find out how many pickers, graders, and packers are used in orchards of varying sizes near you.
19. What two packages are used most commonly for shipping peaches?
20. What are some of the advantages of shipping peaches in bushel baskets? How are they packed?
21. Why should a peach packing shed have two stories?
22. Why are the sides and end of the first story left open?
23. How high above the ground is the first floor of the packing shed? Why?
24. What size packing shed should be used for a 65-acre peach orchard of one variety?
25. What are the three methods of shipping peaches?

26. Which is more expensive—to ship by express or in refrigerator cars?
27. When are express shipments employed?
28. How do most commercial growers ship their peaches?
29. How is the temperature of a refrigerator car kept low?
30. What is the standard size of a refrigerator car for shipping peaches?
31. How many bushel baskets of peaches make a carload and how are they placed in a car?
32. How often are refrigerator cars re-iced?
33. What are the four common methods of selling peaches?
34. What are the advantages and disadvantages in selling for future delivery?
35. Why are peaches usually sold at a lower price when sold for cash than when consigned to a commission house or sold through a cooperative marketing association?
36. What are some of the advantages and disadvantages of consigning peaches to commission houses?

SUGGESTED EXERCISES

1. Visit commercial peach orchards and study methods of picking, grading, packing, and shipping peaches.
2. Inspect a refrigerator car used for shipping peaches, note its construction and methods used for holding ice for keeping down the temperature.
3. Visit markets where peaches are sold, observe the condition of peaches on arrival, and study methods of handling and selling.

SEASONAL WORK IN THE PEACH ORCHARD

November, December, and January

Spray for San Jose scale with lime-sulphur solution or with lubricating oil emulsion. Prune by heading back young trees, taking out all dead, broken, badly diseased or misplaced branches of mature trees. Transplant young nursery trees to missing places in the young orchard.

February, March, and April

If the scale is still present, spray with lime-sulphur solution just before blossom buds swell. Cultivate thoroughly as blossom buds are bursting. Cultivate continuously to keep down grass and weeds and to prevent the surface from becoming crusty and hard. Apply fertilizers as soon as a "crop" is certain.

May, June, and July

Apply third summer spray. Cultivate continuously. Apply fourth summer spray. Harvest and market peaches. Clean up diseased and fallen fruit immediately after each variety is harvested.

August, September, and October

Apply fourth summer spray for late varieties. Finish harvesting. Use paradichlorobenzene for the control of root borers. Cut out broken limbs and dig out the dead trees.

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CHAPTER IX

APPLES—SELECTING THE LAND

Job 1—Selecting the Site for Growing Apples

Before any farmer can determine whether or not he can grow apples successfully on a commercial scale, he must consider carefully the following factors: (1) the climatic adaptation of the region, (2) the amount of capital that will be required, (3) the amount and kind of labor required, (4) the knowledge of apple growing necessary, (5) the markets available, (6) the competition he must meet, (7) the length of time before returns may be expected, and (8) the facilities for transportation.

Climatic Adaptation.—Perhaps the most important single factor in successful apple production is that of climate. A farmer should not plant a commercial orchard in a section where the climate is known to be unfavorable to apple production, though he might plant an orchard for home use or to supply the local market. The apple apparently does best where there is uniformity of temperature and an absence of late spring frosts. The question of minimum winter temperature is not a factor of much concern to the southern apple grower. However, an excessively high temperature during the summer seems to be an important factor with most varieties of apples. Trees grown in a high temperature are relatively small and short-lived. High temperatures above the most desirable summer mean temperature for apples bring about premature dropping, lack of color,

uneven ripening, and poor flavor. Few varieties of apples will give satisfactory results where the average summer temperature is over 68° F. This figure is above the optimum average summer temperature for all varieties of apples. The optimum average summer temperature for the leading commercial varieties produced in the South is in the neighborhood of 62° F.

There should also be rainfall sufficient to keep the trees growing vigorously and to make a crop of fruit. The most reliable guide for determining the probable success of apple growing from a climatic standpoint, is the behavior of established trees in the section.

Capital Required.—Establishing, growing, and operating an apple orchard is much more expensive than similar operations with field crops. The prospective apple grower should give careful consideration to these costs. The cost of producing an acre of apple trees varies greatly, depending on many factors, such as size of orchard, location, topography, preparation and care, cover crops, fertilization, labor, and equipment. Estimates of a great many growers show a range of from \$35 to \$150 a year, or from \$350 to \$1,500 for a period of ten years. A prospective grower should investigate the probable cost carefully so as not to plant more trees than can be given the best of attention.

Labor.—The amount and kind of labor may seem unimportant to one inexperienced in apple production. A farmer is safe in assuming that much more labor will be required than he anticipates if he is to give the orchard the attention which it requires. Also, the labor will have to be of a more skilled type than that commonly employed in the production of farm crops. In sections where general farming is practiced, the labor is

not likely to be as skilled as in a section where apple growing is a major industry.

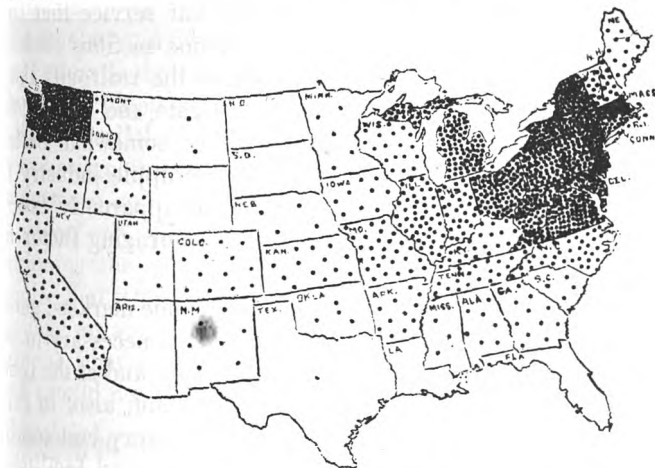
Knowledge Necessary.—While a section may possess remarkable natural and economic advantages for apple growing, there is required a certain amount of horticultural information on the part of the grower before success can be attained, for apple growing has become a highly specialized business, requiring specialized knowledge. To the type of man who will become more or less of a specialist, apple production is a growing enterprise. The increased ravages of insects and diseases, together with a demand for better fruit, are operating in his favor by making it unprofitable for the uninformed to continue in the business.

Markets Available.—A farmer, before planting an apple orchard, should determine whether he will grow apples for distant or local markets. In most towns there is a good demand for limited quantities of certain varieties of apples. If a farmer expects to grow apples for commercial markets, he must determine whether or not his section will produce apples of a type and quality that are commonly offered on these markets.

Competition.—The commercial grower of apples must take into consideration the fact that he is in a highly competitive business. As a result of changing conditions—such as concentration of population in cities, decrease in number of food producers in rural sections, improved railroad facilities, development of improved canning, handling, and storing facilities—the production of apples has become one of the chief agricultural industries. These conditions, too, have brought about national standards of quality and have developed industries rather than individual activities. Apples in

large volumes have become articles of commerce, many different producing sections have been developed, and oftentimes they are in direct competition with one another in the same market. Apples sometimes compete also with other types of fruit. Practically all of the large commercial markets are supplied with several types of fruit for the selection of the consumer.

The farmer who is producing apples for local markets can very accurately survey the production of orchards and other crops in his section and, consequently, determine the amount of competition that he may expect. The competition from other growers and other crops is important in determining the market for his own products.



APPLE PRODUCTION IN THE UNITED STATES

Each dot represents 100,000 bushels.

Returns.—The length of time before returns may be expected from the apple orchard is a very important factor with most growers in determining whether or not

to plant an orchard. With most varieties in the South, growers may expect some returns from the fruit in five to seven years, provided they have followed the most approved orchard practices. In many instances, by a system of intercrops, the expense of establishing the orchard and the burden of carrying it during its first years may be greatly lessened.

Transportation Facilities.—The question of transportation facilities is very important from the standpoint of commercial apple production. If the packing house can be located directly on the railroad, much time and money may be saved not only in shipping the crop but also in receiving supplies. It is desirable to look into the matter of the refrigerator car service that the railroads of the section supply. Some sections receive far superior service at the hands of the railroads than others. It is important to investigate the matter of freight rates. Some sections enjoy somewhat better freight rates than others. Where the apple industry is getting started in a region, high and apparently excessive freight rates may be a very discouraging factor in the expansion of the industry.

Of course, from the standpoint of home markets, good roads are of primary importance. It is necessary to be in a position to supply the market easily and at the time that the fruit is desired. It is important, also, in this connection, to deliver the apples in the very best condition. Many orchards, because of good road facilities, are selling most of their production to buyers who come direct to the orchard. People in towns rather enjoy visiting orchards if they are easily accessible. Many small growers located near the large cities and towns are marketing their entire crop by means of attractive displays of apples in roadside stands.

If, after studying these factors, it appears that apple production is an enterprise to which the farm is adapted, then the potential grower must determine (1) what acreage to plant, and (2) the most suitable site for the orchard.

Acreage to Plant.—The acreage to plant will depend upon (1) amount of capital available, (2) amount and kind of labor available, (3) type of markets to supply, and (4) ability of grower to manage an apple orchard.

The prospective grower should plant an acreage no greater than that which he is certain can be financed through the period of establishment, and the operation of which he can finance when it is on a bearing basis. The number and the class of laborers available are limiting factors in the size of an orchard. No larger orchard should be planted than for which an ample amount of labor is available. Where the fruit is being produced for a commercial market, the market is not of much importance as a limiting factor; but where the market is a local one, it assumes a very great importance in determining the acreage to plant. The grower should realize that it takes considerable ability to successfully manage an apple orchard of any size. He should determine what size orchard he can successfully manage and should not overstep this limit.

Selecting the Site.—In selecting the most suitable site of the orchard, the grower will have to consider (1) soil type, (2) elevation, (3) air drainage, (4) water drainage, (5) slope, and (6) accessibility.

An elevation considerably above the surrounding area is to be desired in selecting a site so as to afford both water and atmospheric drainage, primarily the latter. It is not so much the height of the elevation, but the

relative height above the surrounding country which affords good atmospheric drainage. While there are some very successful orchards on level land, it is best to choose an elevation, everything being equal, for planting an orchard on an elevation is one of the best means of insuring against frost. An elevation insures better air drainage in summer, which means higher colored fruit and less damage by rot. A site which is exposed to strong, prevailing winds is not desirable because the young trees will be badly blown about before they become established in the soil.

Cold, frost-laden air settles from a higher elevation to a lower one. This accounts for the fact that fruit is often produced on hillsides while trees in the valleys or at lower levels have their blossoms or fruits destroyed by frost. In a section of hilly or mountainous topography, it is often noticed that the vegetation on the lower part of the mountain is killed by frost, while above this frost-killed area there is a belt where the vegetation is unharmed. This condition is explained by the phenomenon of atmospheric drainage.

Proper water drainage consists of surface and sub-surface drainage. Water must not stand on the land, neither should it run off rapidly and cause washing and excessive leaching.

The slope or exposure of an orchard site is the direction towards which the land slopes or inclines. In many instances the importance of exposure has been exaggerated, but it is generally conceded that trees on a very decided southern slope will usually bloom earlier and mature fruit sooner than trees planted on a corresponding northern exposure. Unless extreme differences in slope exist, however, there will be very little difference in the blooming and ripening periods. A rather moderate slope should be chosen in preference to a steep one,

because soil management will be more economical on the former.

The apple will grow on a wide range of soils but the ideal soil type is one which is well drained and through which the roots can penetrate easily to a depth of at least six to eight feet. This volume of soil will provide a reservoir of water and mineral nutrients to amply provide for the trees' needs. Soils which are underlain by hardpan at a depth of 18 to 24 inches are unsuited for an apple orchard. Orchards on such soils are unproductive and short-lived.

Everything else being equal, a site that is readily accessible from the standpoint of roads and railroads is desirable. If the orchard is a commercial one, it is of much value to have it located adjacent to a railroad. If the orchard is being operated to supply local markets, location on a good road is extremely important.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Before planting an apple orchard, what is the important decision that the farmer has to make?
2. What are the principal factors that must be taken into consideration in making this decision?
3. What is the optimum average summer temperature for varieties of apples commonly produced in the South?
4. What is the estimated cost of producing an acre apple orchard?
5. What two general types of markets are available for apple growers?
6. What length of time will elapse before returns may be expected from apples?
7. What are the points to consider from the standpoint of transportation in locating an orchard?

8. What factors influence the acreage that a grower should plant?
9. What considerations should guide a prospective apple grower in selecting an orchard site?
10. Discuss the importance of elevation in selecting an orchard site.
11. What is meant by air drainage?
12. Discuss the proper water drainage for an orchard site.
13. What is meant by the term slope when used in connection with an orchard site?
14. What type of slope is most desirable?
15. What are the main essentials of a good apple soil?

SUGGESTED EXERCISES

1. Make a survey of the territory served by the school, recording the number of apple orchards, number of apple trees, types of sites, condition of trees, attention they have received, and the profitableness of the orchards. Use this information in an effort to determine whether or not the section is adapted to commercial apple growing or apple growing for home use.
2. Study the weather records of the nearest United States Weather Bureau Station to determine whether the climate of the section is suitable for apple growing.
3. The class should make a field trip with the idea of seeing good and poor orchard sites in the community. Every member of the class expecting to take a project of planting an apple orchard should select their sites early in the fall.
4. Study the statistics on apple production for the United States, and in a graphic way show the place that your own state occupies in relation to other states.
5. Study the statistics on apple production for your own state, and in a graphic way show the relative importance of your own county in apple production.

CHAPTER X

APPLES—PROCURING TREES FOR PLANTING

Job 2—Procuring the Trees for Planting

After the farmer has determined to grow apples and has selected the site for the orchard, his next job is that of procuring trees for planting. This job also includes the problem of selecting the varieties to be grown.

What Varieties to Plant.—The varieties that the grower selects will depend upon: (1) adaptability to the section, (2) adaptability to the soil, (3) market demands, (4) type of market, (5) productivity, (6) quality, and (7) pollination.

The prospective orchardist should select varieties that have demonstrated their adaptability to the particular section in which they are to be grown. The grower runs the risk of disappointment and failure in planting varieties that have not been tried out under his conditions. A grower may determine which varieties are best adapted to his section by securing information from his own state agricultural institutions and by drawing upon the experience of growers in his section.

It is important to select varieties that are adapted to the type of soil available. The necessity for selecting the varieties adapted to the soil type is most forcefully illustrated by the experience of fruit growers. Many growers have found, after years of waiting, that certain varieties would not give profitable crops under their soil conditions.

Whether growing apples for a distant market or for a

local market, those varieties should be selected which the market demands. The grower should rarely attempt to force the market to take the varieties of his own selection if the market desires something different. If the fruit is to be produced for the commercial market, it will be necessary to select a few of the varieties most commonly sold on those markets. On the other hand, if the crop is being produced for the local market, it will probably be necessary to select a much greater number of varieties and select them from the standpoint of supplying fruit over a long season and with more regard to the quality.

Other things being equal, varieties should be selected that produce healthy trees which are productive. These are the most profitable kinds.

Many orchards have proved to be unsuccessful because the varieties were selected without knowledge of the need of cross-pollination. Many desirable varieties are self-sterile and need to be planted with other varieties so that they may be properly pollinated before they are productive. The prospective apple grower should take this matter into consideration and select varieties that will provide for ample pollination throughout the orchard.

How to Proportion Varieties Selected.—The proportioning of the varieties selected will depend upon the markets to be supplied and the adaptability to the section.

Just as the market determines the varieties to plant, so it determines the amount of each variety that should be planted. If the fruit is produced for commercial markets, the greater proportion may be given to one or two varieties, and just enough trees of other varieties to afford good pollination. For commercial markets few

varieties should be planted. In the case of a local market, the important consideration is to have a supply of fruit over a long period of time; consequently, the apportionment of varieties should be made with this in mind. In this case, there may be a number of varieties of equal importance in the orchard.

From both the standpoint of a commercial orchard or a home orchard, the adaptability of the section for growing certain varieties may be important. In some instances certain varieties may be in much demand but grow only fairly well under the conditions present. In such a case it may be desirable to have a certain number of trees of these varieties, but their adaptability will prove a limiting factor.

DESCRIPTION OF VARIETIES

Yellow Transparent.—Tree vigorous, upright, round-headed, productive. Fruit medium, roundish, oblate, conical. Cavity regular, acute, russeted; basin narrow, shallow, corrugated. Calyx closed. Surface smooth, light yellow; dots numerous, large, white. Flesh white, tender, juicy. Flavor pleasant, sub-acid. Core half open. Good. Summer.

Red Astrachan.—Tree upright, vigorous, spreading, productive. Fruit medium, roundish, conical. Cavity shallow, regular, obtuse, russeted; basin shallow, smooth. Calyx small, closed. Surface smooth, greenish yellow, almost entirely covered with mottled and striped red crimson. Flesh white, crisp, moderately juicy. Flavor brisk, acid. Very good. Summer.

Red June.—Tree erect, vigorous, productive, hardy. Fruit medium, irregular, roundish, oblong, conical; cavity narrow, regular, acute with slight trace of russet; basin narrow, smooth or slightly corrugated. Calyx closed. Surface smooth, dots minute, obscure. Flesh fine grained, white, tender, juicy. Flavor agreeable, acid. Core rather large; seed black-brown, numerous. Good. Early market.

Horse.—Tree vigorous, productive. Fruit medium, roundish, oblate. Cavity deep, acute, russeted; basin abrupt, corrugated. Calyx closed. Surface yellow, shaded with red blush; dots few, sunken, large, gray. Flesh yellow, firm, coarse, tender. Flavor pleasant, subacid. Core large, partly open. Good. Late summer.

Bonum.—Tree upright, spreading, hardy, productive. Fruit medium, regular, oblate. Cavity regular, wide greenish russet; basin wide, shallow, slightly corrugated. Calyx closed. Surface yellow, mostly covered with red and crimson splashes; dots numerous, distinct, russet with dark center. Flesh white, often stained, firm, tender, juicy. Flavor aromatic, mild, subacid. Core small, closed. Seed numerous. Very good. Autumn.

Grimes Golden.—Tree erect, spreading, vigorous, productive. Fruit medium, regular, roundish, oblate. Cavity regular, medium, slightly russeted; basin abrupt, uneven. Calyx closed or partly open. Surface even, rich golden yellow; dots many, obscure, white. Flesh yellow, firm, crisp, juicy. Flavor rich, aromatic, spicy, subacid. Core small. Seed many, short, plump. Fine. Winter.

Delicious.—Tree large, vigorous, makes rapid growth, somewhat spreading. Fruit large, conic with distinct ribs which end in points at the blossom end, forming a five point crown. Skin tough, glossy; color pale yellow nearly overlaid with a solid red blush. Flesh yellowish, firm, fine grained, crisp, very mild, subacid, very good to best. October to March.

This apple has won a place on the market as a high quality dessert fruit, and as such is in active demand. No apple in recent years has received as much publicity as this variety. It is especially adapted to fruit stand trade. It is well adapted to western Carolina conditions and reaches a high degree of color and quality in this section. It should be included in every home and commercial orchard in the state.

Virginia Beauty.—Tree vigorous, spreading. Fruit medium, roundish, conical. Surface greenish yellow, streaked and

striped with red and purple. Cavity regular, deep, russeted; basin shallow, broad. Calyx open; dots numerous, obscure, bronze. Flesh greenish yellow, firm, juicy. Flavor sweet. Very good. Late winter.

Stayman.—Tree vigorous, open, irregular, spreading, productive. Fruit medium, oblong, conical. Cavity wide, deep, russeted; basin narrow, abrupt, shallow, furrowed. Calyx large, partially open, erect. Surface greenish yellow, mostly covered with indistinct red stripes and splashes. Flesh yellow, firm, tender, juicy. Flavor rich, mild, subacid. Core medium. Very good. Late winter.

Rome (Beauty).—Tree moderate grower, round-headed, productive. Fruit large, roundish, oblate, conical. Cavity wide, obtuse, lined with greenish russet; basin smooth, deep, abrupt. Calyx closed. Surface smooth, pale yellow covered with red, splashed and striped; dots distinct, abundant, russeted. Flesh yellowish, tender, juicy. Flavor sprightly, subacid. Good. Early winter.

Winesap.—Tree moderately vigorous, open, straggling head, very productive. Fruit medium, roundish, oblong, conical. Cavity wide, regular, acute, russeted; basin narrow, shallow, corrugated. Calyx closed. Surface smooth, dark yellow, mostly covered with splashes and occasionally stripes of rich, dark red; dots few, minute. Flesh yellow, firm, crisp, fine grained. Flavor rich, sprightly, subacid. Core slightly open; seed medium, few, short, plump. Very good. Late winter.

Terry.—Fruit small, roundish-conic. Color yellow splashed with red. Flesh yellow. Flavor subacid. Quality very good. Late winter.

Yates.—Tree upright, productive. Fruit small, oblate, conic. Cavity large, slightly russeted; basin shallow. Calyx small, closed. Surface whitish yellow, shaded, striped and splashed with shades of red; dots numerous, small, light. Flesh white, sometimes stained next skin, tender, juicy. Flavor pleasant, subacid. Excellent. Late winter.

OPTIMUM TEMPERATURES FOR DIFFERENT VARIETIES OF APPLES

56° to 59° F.	60° to 63° F.	64° to 67° F.
Baldwin	Arkansas Black	Ben Davis
Cortland	Delicious	Gano
McIntosh	Golden Delicious	Limbertwig
Northern Spy	Grimes	Shockley
Oldenburg	Rome Beauty	Terry
R. I. Greening	Stayman	Winesap
Wealthy	York Imperial	Yates
Kinard	Yellow Newtown	

Propagate or Purchase Nursery Stock.—Whether or not the grower propagates trees or buys nursery stock will depend upon (1) the time trees are needed, (2) quality of stock desired, (3) relative costs, and (4) grower's experience.

Most growers will find it much more satisfactory to purchase nursery stock than to attempt to propagate their trees. Generally, the grower does not care to wait a year or two to start his orchard, and ordinarily, it requires this length of time to propagate stock. Then, too, home-propagated trees vary greatly in quality and uniformity. The cost may be slightly less, but compared with the quality of stock produced, it is generally greater. Few growers have the necessary experience to produce first-class stock.

When to Buy Trees.—Having decided on the varieties and the number of trees, it is desirable to place the order as early as possible. Nurserymen dig the trees in the fall and sell them through the winter and spring. It is best to place the order in the late summer or very early fall, for by so doing it is possible to obtain good stock and to secure it in plenty of time for planting. If the order is delayed it may be found that the very varie-

ties desired are sold out. The nurseryman should be cautioned not to dig the stock too early and not to strip the leaves before the wood is ripened, as this practice weakens the tree.

Where to Purchase Trees.—Too much care cannot be given to the matter of securing good stock. An orchard planted with weak and diseased trees is doomed to be an unprofitable one. The important factor in the selection of trees is to secure a healthy, strong, vigorous stock, free from disease and insects, and true to name. The question often comes up whether it is best to purchase trees nearby or from a distance, and whether trees should be purchased from the North or from the South. In answer to this question, it may be said that it makes very little difference where the trees are grown if they are vigorous, well grown, and free from disease and insects. The cost of transportation is a factor, but it is a secondary one. Other things being equal, however, the trees may be purchased from a nearby source, thus reducing the cost of transportation.

From Whom to Buy.—The question often arises whether or not it is best to purchase trees direct from the nursery or from the nursery agent. It is generally much cheaper and more satisfactory to purchase stock direct from the nursery than from other agents. The main point is to secure trees that are of high quality which are true to name. The best assurance that the grower has in this problem is to deal only with nurserymen who, by honest dealings, have gained a well-merited reputation for reliability.

Age and Size of Trees to Buy.—Experience and observation have brought most horticultural authorities and nearly all fruit growers to the conclusion that one-

year-old trees are best, and that one-year-old whips are more desirable than branched trees. There are a number of advantages in favor of the one-year-old trees in general, and specifically in favor of the one-year-old, four- to six-foot whip. In the first place, one-year-old



Courtesy of R. D. Massee

BEARING APPLE TREE

trees can be headed uniformly and at the correct height. The limbs that form the framework can be developed the proper distance from the ground, according to the most approved system. A more uniform bearing orchard can be produced because the growth of the trees can be more definitely directed. One-year-old trees will come into bearing just as soon as older trees planted at the same time. Another important consideration is that one-year-old trees are cheaper to plant: they cost the fruit grower less, and the loss during the first season is reduced. Trees of this age stand the shock of transplanting better than older trees. In the case of apples, it is desirable to use one-year-old trees that are at least four feet high. The important consideration from the

standpoint of size and grade is to secure well-grown, vigorous, straight, healthy trees, free from insects and diseases, with a strong, vigorous root development, and trees which are true to name. The prospective grower will be faced with the problem of whether he shall buy low-priced trees or high priced trees. He should first assure himself that he is getting the type of stock desired and then let the price be a secondary consideration.

Treatment of Trees Upon Arrival.—On receiving a shipment from the nursery, it should be unpacked at once to note the condition of the trees. Care should be exercised not to expose the roots to sun, air, wind, or frost, for they will soon be dried out. If possible, trees should be planted as soon as they arrive. If planting is to be deferred, the trees should be heeled in. This is accomplished in the following manner:

A trench 20 inches to 2 feet deep is dug, throwing the soil forward so as to make a sloping bank on which the trees are placed in a slanting direction with roots in the trench. The trees should be taken from the bundles and laid in thin layers. After working the soil in well around the roots and tops, packing it firmly, a second trench is dug a little farther to the front and handled in the same way. Where there are large numbers of nursery apple trees to be heeled in and space is very limited, the trenches may be made close together, allowing the tops of the young trees to lap over the roots and bodies of the row previously put down. This is somewhat after the fashion of shingles put on a house. The heeled-in trees should be protected against surface water by means of border trenches. Where there is no danger of freezing, drying out, or rabbit injury, only the roots need be covered. These trees should be taken up and set to the orchard as quickly as is practicable, so as to get the roots

well established before spring opens. In the South, newly set trees make some root growth during the winter.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. In procuring apple trees for planting, with what two problems is the grower confronted?
2. What two decisions must the grower make in selecting varieties for planting?
3. What decisions must the grower make in securing the trees?
4. The selection of varieties for planting will depend upon what considerations?
5. What varieties are grown in your community?
6. What varieties are recommended by your state agricultural college?
7. The proportioning of varieties selected will depend upon what considerations?
8. Discuss influence of type of market on the selection of varieties.
9. Discuss the advisability of a grower propagating trees for planting.
10. When is the most desirable time to buy trees?
11. What is the principal consideration in buying trees?
12. Is there any difference in purchasing trees from the North or from the South?
13. Is it best to purchase trees direct from the nursery or from the nursery agent?
14. What factors should be considered in judging the nursery?
15. What age and size of apple trees are most desirable?
16. What are the advantages of such trees?
17. What characteristics are possessed by a desirable nursery tree?
18. What attention should trees receive upon arrival?
19. Describe the operation of heeling in trees.

20. How many inches deep does the soil freeze during the coldest winter weather in your community?
21. Name those varieties that are considered to be commercial kinds in your community.

SUGGESTED EXERCISES

1. Make a survey of your community to determine the names of the varieties grown and which are best for the section.
2. Secure specimens of the principal varieties of the community. Make descriptions of them and study them until they are well known.
3. Visit a nursery, if there is one in the section, and learn how apple trees are propagated.
4. Secure trees of different grades and become acquainted with the different grades. Learn to recognize a good tree.
5. Secure catalogs from different nurseries and compare grades of trees and prices.
6. When shipments of trees are received in the community, try to be present when they are unpacked to note how they are packed and see how they are heeled in after unpacking.

CHAPTER XI

APPLES—PLANTING THE TREES

Job 3—Preparing the Land

The proper preparation of the land before planting an orchard and careful planting of the trees afterwards are highly essential for the best results. The job of preparing the land before planting an orchard requires five decisions: (1) whether to give a year of preparation, (2) whether to plow land in the spring or fall, (3) how deep to plow, (4) whether to terrace the land, and (5) what implements to use in preparing the land.

Amount of Preparation.—The amount of preparation will depend upon whether the land is freshly cleared or has been cultivated, and on the condition and the type of soil.

Practically all lands, whether freshly cleared or cultivated, should be given a year's preparation before setting an orchard. If the orchard is to be planted on freshly cleared land, a cultivated crop, such as corn or cotton should be grown on the land for a year at least before planting the orchard. Any crop that is suited to the conditions of the location, and that requires frequent cultivation may be used. This gives opportunity for clearing the land of stumps and roots and puts it in the best condition for planting. If the soil is lacking in fertility and humus, whether it be freshly cleared or old land, a soil improving legume, such as cowpeas or soybeans should be grown and turned under in the fall before the trees are planted.

Spring or Fall Plowing.—Fall plowing in the preparation of land for an orchard is generally advisable. If the orchard is to be planted in the fall it is necessary that the plowing be done in the spring. In many cases, however, where the orchard is to be planted in the spring, the land may be put in better condition for planting if plowed in the fall. Where the land is so steep that loss of fertility in the soil will result from washing, it will not be desirable to plow much before planting. In such a case, where spring planting is to be practiced, fall plowing should be omitted. Fall plowing is particularly desirable on land which is heavy or in sod. Fall plowing increases the feeding area of the roots, improves the physical condition, and liberates plant food. Lands that tend to wash badly if plowed in the fall should be planted to a winter cover crop.

How Deep to Plow.—The land should be plowed deep—that is from six to eight inches. This is much deeper than is possible with the one-horse plow that is generally used throughout the South. Much of the plowing which is done would not be considered good preparation for an orchard, because it is too shallow. By deeper plowing the feeding zone for the root system is increased and more plant food is made available.

Terracing the Land.—In many orchard sections the land is sloping and the orchard site may be so steep that there is much danger of washing. Each year, through soil erosion, much soil fertility is lost to the farmers of the United States. The best soil is carried away and ditches and gullies are formed. This is a frequent occurrence in young apple orchards in hilly country. This loss may be prevented through proper terracing.

Pulverizing the Soil.—If the land has been broken in the fall and a winter cover crop or the trees are to be planted, it should be pulverized immediately. But if the trees are not to be planted until spring, the land need not be pulverized until just before planting. The essential point is that the land should be well pulverized before planting, by disking or harrowing, or both. A site in good surface condition can be more easily and neatly planted than one which is rough and full of roots.

Implements.—Since an orchard should be plowed to a depth of six to eight inches, a two-horse plow will be required. For pulverizing the land, a disk harrow may be used. In some instances it will be necessary to use both the disk harrow and a spring-tooth cultivator. In some soils that are so rocky that a disk harrow cannot be used, a spring-tooth harrow will give the best results. In large orchards, where the topography of the land permits, plowing and pulverizing the soil may be done with tractors and tractor implements. The type of implements used will also depend upon the acreage. Where the acreage is over 15 acres, power implements, if the type of soil permits, should be used.

Job 4—Laying Out the Orchard and Planting the Trees

The job of laying out the orchard and planting the trees involves making eight decisions: (1) whether to plan orchard on paper previous to planting, (2) system of arrangement, (3) arrangement of varieties, (4) whether to plant in spring or fall, (5) how to lay off rows and locate trees, (6) the size holes to dig, (7) how much to prune roots before planting, and (8) depth to plant.

Plan of Orchard.—Whether to plan the orchard on paper previous to planting will depend upon the number of varieties and the complication of arrangement.

Very few planters prepare a plan for planting the orchard previous to setting the trees. This is a good practice in any case and is almost imperative where there are a large number of varieties, or where the arrangement of varieties is at all irregular or complicated. A plan designating the location of the different varieties is a valuable guide in planting and an invaluable record in handling the orchard after it is established.

System of Arrangement.—The system of arrangement for the trees will depend upon the topography and the shape of the orchard site.

There are four general methods of arranging trees in the orchard. In the square method each tree stands at the corner of a square. This is the most common method and is an easy system to lay off. The triangular method is like the square except that an additional tree is placed in the center of each of the squares. This tree is commonly used as a "filler" or temporary tree. In the hexagonal method each tree stands in the center of the hexagon formed by six trees, and is equally distant from each of them. This method has a distinct advantage in that it best utilizes the space of the orchard. A fourth plan, commonly employed in steep locations, is known as a contour plan, in which trees are planted to follow the contour of the land.

Arrangement of Varieties.—A more satisfactory orchard can be established if attention is given to the arrangement of the varieties. It is convenient from the standpoint of spraying to have the varieties arranged so

that by going through the orchard each block may be sprayed at the right time. It is better to locate the early-blooming varieties at higher levels so that they will be less liable to frost injury. It is desirable to have varieties arranged according to season of ripening for convenience in harvesting. Due to many varieties being self-sterile, it is not advisable to plant more than four rows of a single variety in one block. A self-sterile variety is one whose pollen will not properly fertilize the flowers of the same variety. From a pollination standpoint, it is the best practice to avoid large blocks of any similar varieties, and to plant varieties of the same blooming period in adjoining areas.

Time of Planting.—The time of planting depends largely upon the climate and season.

In the South, trees may be planted any time from November until early spring, but fall-planted trees usually give the best results. Fall planting in the South has several advantages. It is the most convenient time, there being less general farm work to be done than in the spring. The tree heals, the cut roots become established, and it is ready to start growth in the spring. Fall-planted trees generally have made more growth by the end of the first season.

If the land is too wet, fall planting is not desirable. Trees set out in the spring should be planted early.

Laying Off Rows.—The method to employ in laying off rows and locating trees depends largely upon the topography of the site and the size of the orchard.

Trees are commonly set in squares except where the land is so steep that it is necessary to plant them in contours to follow the contour of the site. A great deal of care should be exercised in laying off the orchards to have the rows straight in all directions. It often becomes

a very important point where machinery is being used to cultivate the orchard.

In laying out the orchard according to the square system, base lines are run across the ends and sides of the site with stakes at intervals equal to the distance between the trees. Furrows are plowed from stakes on one end to corresponding stakes on the other end; then furrows are plowed across the fields to corresponding stakes on the sides. The intersections of the furrows locate the positions of the trees. If the field is a large one, stakes should be set in a line between the end stakes to assist the plowman in keeping the rows straight.

If more accuracy is desired, stakes are lined in rows between the base lines on the ends and sides of the orchard, driving a stake in the ground where each tree is to be planted. The stakes are lined up accurately and the trees are lined up again as they are being planted. This insures rows being straight in all directions.

Apple trees are commonly set 40 feet apart. The distance will depend, however, upon the variety and topography of the site. Vigorous growing and long-lived varieties should be given more room than weak, short-lived types.

Digging the Holes.—The hole in which the tree is to be set should be of sufficient size and depth so that the roots may rest naturally, without crowding or bending. The topsoil should be put to one side so that the richest soil may be placed around the tree roots. The hole should be dug deep enough to allow the placing of some soft, loose, rich soil in the bottom of the hole; however, it is not necessary to dig large holes if the soil has been properly prepared beforehand. For the apple tree of average size on good soil, the holes need not be more than 12 to 18 inches square and about the same

depth. If the trees are to be planted on a soil that is not in good condition, then the hole must be made larger.

Pruning Roots.—The importance of root pruning previous to planting has often been overemphasized. Only a small amount of root pruning is usually desirable, the object being to put the root system in good shape with the slightest amount of removal possible. Little attention need be given the small roots, but any long ones should be cut back to conform to the shape of the hole. All broken roots should be removed and also any ends which are badly splintered. Very often cuts made at digging time are already calloused, and in this case it is a very practical policy to make no cuts which will require new callousing. When pruning the roots the trees should be carefully examined for borers, scale, insects, and root gall. Reject trees that show the presence of these insects and diseases.

Planting.—The planting of the trees is an operation which requires a great deal of attention, as the growth of the orchard will depend somewhat upon the start which the trees receive. The chief requirement is that every part of the root system be in close contact with the soil. A tree should be set at the same depth, or only slightly deeper than, it stood in the nursery row. In setting, one person should hold the tree in an upright position while another shovels or fills the loose soil around it. The man holding the tree should spread out the roots in as natural a position as possible. When the hole is two-thirds full of soil, pack the earth thoroughly about the roots by trampling it with the feet. The top several inches of soil should not be trampled, but should be left loose to facilitate the run-in of rainfall.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. What are the two main essentials in securing the best results in tree planting?
2. In preparing the land before planting, what decisions are necessary?
3. The amount of preparation depends upon what factors?
4. What is the objection to planting on freshly cleared land?
5. Discuss the question of spring or fall plowing.
6. How deep should the land be plowed?
7. What is the advantage of deep plowing?
8. Discuss the question of implements for use in preparing land for planting.
9. Laying out and planting the orchard involves what decisions?
10. What is the value of an orchard plan?
11. The system of arrangement of trees depends upon what considerations?
12. What are the four general methods of arranging the trees in an orchard?
13. Describe the square method.
14. Describe the triangular method.
15. Describe the hexagonal method.
16. Describe the contour method.
17. What distances apart are apple trees commonly set?
18. The arrangement of varieties will depend upon what considerations?
19. What is meant by a "self-sterile" variety?
20. In what way does this influence the arrangement of varieties?
21. The time of planting depends upon what considerations?
22. What are the advantages of fall planting?
23. Describe a method for laying off rows.
24. Discuss the size to dig the holes for setting trees. Upon what does the amount of root pruning depend?
25. How deep should a tree be planted?

26. In planting trees, what is the chief requirement for satisfactory results?

SUGGESTED EXERCISES

1. Visit apple orchards in the community and note the distance between trees and the arrangement of trees; the presence of terraces, where found, and the method of constructing them; and determine whether spring or fall planting has given the best results.
2. Visit farms that are planning to plant orchards and study the method of preparing the ground for planting.
3. Make a study of all tools and implements used in the preparation of the land for apples.
4. Practice laying out an orchard site according to the system that seems most practical for the community, placing a stake where each tree is to stand.
5. Secure some young apple trees, dig holes, prune the roots, and plant the trees.

CHAPTER XII

APPLES—SOIL MANAGEMENT

Job 5—Tilling and Fertilizing the Orchard

When the job of tilling and fertilizing the orchard is accurately analyzed, it will be found that there are decisions to be made before the grower can be certain that he is doing the work in the way which will produce the largest and most profitable crops. These decisions are (1) system of culture to use, (2) when to plow and cultivate the land, (3) type of implements to use, (4) what inter-crops to grow, (5) what cover crops to grow, and (6) how to fertilize.

Systems of Culture.—The best system of culture to use in the orchard will depend upon the topography of the land, the fertility of soil, and the type of soil.

Systems of culture vary greatly in different sections, and local conditions have a very great influence in determining which type of management will give best results. The chief aim in handling orchard soils is to maintain the trees in good vigor and produce a sufficient amount of annual growth to result in annual profitable crops of fruit.

Orchard soils are usually handled in four different ways, namely: (1) combination of cultivation and cover crops, (2) clean cultivation, (3) sod mulch, and (4) neglect.

Cultivation and Cover Crops: This system is probably the best for use in the South where the topography permits. It includes plowing the land early in the spring and following

at intervals by harrowing in order that the surface of the soil may be kept mellow throughout the growing season. Some growers plant soybeans or cowpeas either in rows or broadcast in June or July. If planted in rows the cover crop is cultivated several times and is generally planted earlier than when planted broadcast. These crops are turned under in early fall so as to increase the fertility of the land and to increase the supply of humus. Another variation of the system is to continue clean cultivation through spring and summer until August or September, when rye, vetch, Austrian winter peas, crimson clover, or a combination of these, is sown broadcast in the orchard. This crop is allowed to occupy the land until the next spring, when it is plowed under.

Clean Cultivation: The system of clean cultivation refers to the method of giving cultivations during the spring and summer, and then about midsummer allowing a natural growth of weeds and grass to cover the orchard. Sometimes the orchard is cultivated until September. This system differs from the clean cultivation and cover crop system in that no cover crop is grown either in the summer or in the winter. The objection to this system is that continued cultivation burns out much humus, and clean cultivation year after year without the addition of humus in some form is often injurious.

Sod and Sod Mulch: This system and its various combinations are in extensive use throughout the South. In some instances it is successful, but in the majority of cases it is not so successful as a combination of clean cultivation with cover crops. There are individual cases, however, where the topography of the land makes it necessary to use some form of this system.

Some orchards are grown in the sod and the grass cut for hay and removed from the orchard. From the standpoint of effect upon the trees, this is the most injurious type of orchard management. If, however, it is modified by cutting the hay and using it as a mulch around the trees, with the addition of nitrogenous fertilizer, it may become the most satisfactory method which can be employed in steep orchards. Sod alone

has a very devitalizing effect upon fruit trees in that it takes up some of the soil elements, particularly the nitrates, and withholds them from the trees. It also makes a serious drain on the soil moisture, which in many cases is being needed by the trees. It generally causes a reduction in the size and yield of the fruit.

The sod mulch system differs from the strictly sod method in that the grass is permitted to grow, but is cut several times during the season and either allowed to remain where it falls or is piled around the trees. The mulch not only tends to smother the grass around the trees but increases the fertility and humus content of the soil, and conserves the moisture supply.

The cost of such a system may be more or less expensive than cultivation. If the land is level, it is probable that cultivation will be more economical and desirable. If the land is mountainous and steep, the sod mulch system will probably be more desirable. It prevents excessive washing, and at the same time is the most economical system of management.

Neglect: There are many orchards in the southern states which receive absolutely no soil management. They are, of course, in sod and grass and have seldom been plowed. Such orchards rarely pay for themselves, and such a system is to be discouraged.

Plowing and Cultivating the Orchard.—The plowing and cultivation advisable in the orchard will depend upon (1) moisture, (2) type of soil, (3) cover crops, (4) condition of soil, and (5) weeds.

One of the most important features of orchard cultivation is the annual plowing. This should be done just as early in the spring as it is dry enough to use a plow, if the best results are to be secured, since wood growth and leaves are both formed very early in the season.

The type of winter cover crop will, in a measure, determine when plowing should be done. If plowing would not be delayed too much, it is often advisable to delay a short time to allow more growth of the cover crop so

that an increased amount of material may be turned under. Cultivation thereafter should be frequent enough to inhibit weed growth.

Implements.—The types of implements employed will depend upon the topography of the ground, character of the soil, and size of the orchard.

Every orchardist should have either a disk or cutaway harrow. The ordinary disk harrow has smooth edges to the disk, while in a cutaway harrow the edges are notched. Next to the disk type of harrow comes the spring-tooth, and it should follow the disk in the season's work. It pulls the furrows to pieces and pulverizes the soil. The spike-tooth is not so important as the spring-tooth harrow. It is a smooth type of harrow, especially designed to leave the surface fine and smooth. In selecting implements it is well to choose those that are especially designed for orchard work. It will be found that they will do the work much better and with less danger of injuring the trees.

Inter-Crops.—One of the questions which comes very forcibly to the attention of the grower who attempts to develop an orchard of any size is whether or not to grow inter-crops between the trees to help pay the expenses of the orchard, and then what crops to grow. For the first four or five years in the life of any orchard, there is no great disadvantage in cropping the ground between the trees, if proper care is exercised and if the right crops are chosen.

The inter-crop should have the following characteristics: (1) it should be both a cash and a profitable crop, and (2) it should be an annual crop. In any scheme of inter-cropping, an orchardist should consider the necessity of leaving an area of from three to six feet wide along each row of trees, so that the trees will not be

injured. Cotton is a very good inter-crop to grow in the South. Corn is a poor inter-crop. Late potatoes and other truck crops are generally satisfactory.

Cover Crops.—Cover crops are divided into two classes: (1) legumes, which take nitrogen from the air; and (2) non-legumes, which can use only the nitrogen already in the soil.

Leguminous cover crops include the clovers, vetches, cowpeas, soybeans, and velvet beans. The nitrogen for these plants is taken from the air by bacteria which live in nodules on the roots. This class of cover crops is valuable for building up poor land. Cowpeas, soybeans, and velvet beans are used in summer, while the vetches and clovers are used for winter covers.

Non-leguminous cover crops include rye, oats, buckwheat, and rape. These crops do not add outside nitrogen to the soil, and hence do not enrich it as much as leguminous crops. These crops are generally on the land as a winter cover. Rye is used more commonly than any of the others of this class. Where rye is used, the Abruzzi variety should be employed. Combinations of different cover crops usually give the best results.

Clean cultivation in an orchard, year after year, without the addition of some form of humus is generally unsatisfactory. Maintaining and increasing the supply of humus can best be accomplished by cover crops. A cover crop may be defined as one that is grown for the benefit of the orchard soil, and one that is plowed under in the fall or early spring. The most important objects of the cover crop are: (1) to add nitrogen and plant food, (2) to add humus which makes the soil more retentive of moisture, (3) to prevent washing and leaching, and (4) to improve the physical condition of the soil.

Fertilizing the Orchard.—Fertilizing the orchard is one of the most difficult problems on which to secure definite information, for the reason that there is such a wide range of soil types and orchards differ so much in their treatment. It is largely a matter of each individual grower finding for himself the limiting factors in production and then supplying the deficiency. It may be said that practically all apple trees in the South need some fertilizer. The kind and amount of fertilizer to be used will vary with the location and natural conditions under which plant food material is supplied. Generally speaking, with the exception of soils high in organic matter, nitrogen is the constituent that is most frequently needed by apple trees in the South. Next in importance are potash and phosphoric acid in the order named. The minor elements calcium, magnesium, iron, sulphur, manganese, boron, zinc, and copper are also necessary for the proper growth of the trees, but usually these are present in sufficient quantities in the soil so that their application except in localized areas is not practical.

Ordinarily, the lighter sandy soils of the Coastal Plain need more potash and less phosphoric acid than do the heavier types found in the Piedmont and mountain sections. The heavier soils are more deficient in nitrogen and phosphoric acid, and generally respond to a fertilizer containing these elements. Nearly all Piedmont soils are comparatively low in phosphoric acid, fairly high in potash, with a small amount of nitrogen which varies with the amount of organic matter in the soil. Southern mountain soils are high in potash, low in phosphoric acid, and the nitrogen content varies with the organic matter present. Commercial fertilizer for apple orchards should be relatively high in nitrogen and phosphoric acid. The amount of application should be

determined by the needs of the individual orchard.

On bearing orchards, fertilizer is generally best applied by either a broadcast fertilizer distributor or a grain drill with the fertilizer side set at the proper opening. The fertilizer may be applied to best advantage down the middle of the rows rather than around the trees. However, with small trees, it is best to apply the fertilizer around the tree, exercising care to see that the fertilizer is not applied too closely to the trunks.

Fertilizer is generally applied to apple trees two or three weeks before blooming. Some growers have adopted the practice of giving an additional application which consists mainly of nitrate of soda in early summer.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. When the job of tilling and fertilizing the orchard is accurately analyzed, what decisions will need to be made?
2. What factors influence the system of culture to be used in the orchard?
3. What is the chief aim in handling orchard soils?
4. In what four different ways are orchard soils usually handled?
5. What is meant by the system of cultivation and cover crops?
6. What is meant by the system of clean cultivation?
7. What is meant by the system of sod and sod mulch?
8. What is meant by the system of neglect?
9. Which is probably the best for the South?
10. Which system is most commonly used in your community?
11. Do you think it is giving the best results?
12. The plowing and cultivation of the orchard will depend upon what factors?
13. When should the orchard be plowed?

14. What general recommendations of tillage will be used by the successful orchardist?
15. What are the purposes of tillage?
16. What implements are generally used in cultivating an orchard?
17. What implements are used in your community for this purpose?
18. The growing of inter-crops in an orchard depends upon what consideration?
19. What are the characteristics of a good inter-crop?
20. Is cotton a good inter-crop for a young orchard?
21. The type of cover crop grown in the orchard will depend upon what factors?
22. What are the two classes of cover crops?
23. Give examples of each class.
24. What is the definition of a cover crop?
25. What are the important objects of a cover crop?
26. What are the important factors in fertilizing an orchard?
27. How is the best way to apply fertilizer to a bearing orchard?
28. When is the best time for applying fertilizer?
29. Do the orchardists in your community use fertilizer on their trees?

SUGGESTED EXERCISES

1. Visit apple orchards in the community and study the different systems of culture, the implements used, the inter-crop and cover crops, and the kind and amount of fertilizers used.
2. Write your state college of agriculture for their recommendations on fertilizing apple trees.

CHAPTER XIII

APPLES—TRAINING AND PRUNING

Job 6—Training and Pruning Apple Trees

There is more doubt on the part of the orchardist about methods of pruning than about almost any other orchard operation. So many variable factors have to be considered that it is difficult at times to combine all of them and decide on what is best to do. In spite of these variable and influencing factors, there are certain fundamental principles which, if followed, may simplify to a great extent and standardize methods of pruning. The job of pruning and training apple trees involves six decisions: (1) the height to head the trees, (2) the system of training to use, (3) how to prune young trees, (4) how to prune bearing trees, (5) the time of year to prune, and (6) how much to prune.

Height of Head.—What height to head will depend upon the system of training. Immediately after the trees are planted the young trees should be pruned. This pruning determines the height of head. One-year-old whips should be headed at 28 to 30 inches.

Type of Training.—The system of training adopted should be one that takes into consideration the mechanical strength of trees, early bearing, and productivity. Experience of the various experiment stations and of the best growers has demonstrated the advisability of training trees according to the modified leader to attain these objects best. The tree is low-headed, spreading, and with six to ten scaffold branches distributed along and

about the central stem. It is not possible to secure the several scaffold limbs from one season's growth and have them properly distributed and in proper balance; so the selection must extend over some three or four years, starting two or three new scaffold limbs each year.

Pruning Young Trees.—If a one-year-old whip has been planted and headed at 28 to 30 inches, the first year's growth will usually consist of an almost upright shoot produced from the uppermost bud and several shorter ones from lower buds. In this case two or three of them well distributed about the trunk, and six to eight inches apart, should be selected in addition to the uppermost one, and the others removed. If the leader is properly dominant and the scaffolds are balanced and not over 24 inches long, they need not be headed back; if too long or not balanced, they should be cut to balance and the leader shortened.

With the second pruning, the leader should be treated in much the same manner as in the previous year. In some cases the scaffold branches will probably have to produce several laterals. In this case the end stem of each scaffold should be kept properly dominant either by thinning out or heading out laterals.

In many cases the third pruning will provide enough scaffold limbs, but if not, others may be left at the time of the fourth or even the fifth pruning. A balance between scaffold limbs should be maintained and the leader kept dominant by thinning out and heading back.

Subsequent prunings should maintain the framework in proper balance, and keep the tree open to allow the entrance of sunlight.

The pruner should develop scaffold branches carefully. They should be handled from the standpoint of

the tree as a whole, and also with regard to the relation of the main branches on each tree. If certain scaffolds are outgrowing others, the stronger growing ones should be headed back or some of the lateral branches thinned out. If the lower scaffold branches are developed sufficiently, the upper ones must be cut back to prevent the lower ones from becoming suppressed as real scaffolds



Courtesy of G. C. Starcher

A BEARING APPLE TREE WELL PROPPED TO PREVENT FRUIT BREAKING THE LIMBS

and the tree thrown out of balance. All main branches of the tree must be properly dominant and their balances carefully preserved. All fruit spurs developed in the middle of the tree during this time should be left. It is on this growth that some of the first fruit of the tree will be produced.

With the framework of the tree well established, the pruning should consist in the removal of injured and diseased branches, the removal of crossing and close, parallel branches, and the thinning out of such new growth as will not be needed. Although this treatment

is light in character it should be given annually. The apple tree that has been properly trained according to the modified leader type has a well-developed fruiting system, so a light annual pruning in the form of thinning out lower branches is about all that is necessary with the exceptions as noted above.

Time of Year to Prune.—The time of year to prune will depend upon the object of pruning, the weather, and labor conditions.

In the majority of cases the annual pruning will be given during the dormant season. In training young trees, if certain scaffold limbs are becoming unbalanced, summer pruning is desirable to restore the proper balance.

Amount of Pruning.—The modified leader system of pruning really requires less severity of cutting than the open-head system, which many growers have practiced, and which some growers still continue to use. Generally more pruning is required with young trees to correct their habits of growth than with older trees. However, with mature trees in a weak, crowded condition, it is necessary to do rather heavy cutting to invigorate them.

As a general rule, growers have been cutting their trees too severely. This cutting has consisted largely in cutting back limbs and twigs, and has failed, in a large measure, to obtain the desired results. Investigation and experience have established the fact that more satisfactory results can be secured in general where the practice of heading back is reduced to a minimum and the pruning largely that of thinning out.

With heavy annual cutting back of the shoots, the total growth is less, the leaf surface is reduced, and the fruit supply is lessened, with the result that the pruned

trees are much smaller with a succulent type of growth that is opposed to fruitfulness. Light pruning or thinning out with a minimum heading back results in trees coming into bearing from one to four years earlier, and in trees which are more productive. This system permits the admission of more sunlight to the interior of the trees which stimulates the production of a continuous fruit spur system throughout the tree. Trees need some corrective pruning, and growers should not go to the extreme of giving no pruning at all.

Renovating an Old Orchard.—Often there is an old orchard on the home farm that has been neglected, or one may acquire a farm on which there is such an orchard. In such cases the farmer must determine whether this old orchard is worth renovating. If the trees are vigorous, even though old, it will usually pay to give them special attention. The spraying and soil management required to bring such trees into a healthy and thrifty condition will not differ materially from the care given the younger orchard. Special attention, however, should be given to properly pruning the trees.

All dead wood and cankers should be cut from the trees. In cutting large limbs it is best to make two cuts, the first about a foot above the other to prevent splitting.

Large wounds after drying out should be painted with white lead paint to prevent the entrance of the different heart rot organisms.

When pruning small limbs it is best to cut to an outside lateral growth in order to prevent the remaining part from dying. In pruning such old trees it must be borne in mind that all of the necessary work cannot be done in any one year, but must extend over a period of three or four years. The first year the removal of dead wood and a light thinning out may be all that is desir-

able. A common mistake is to cut out too much of the top with the result that the remaining limbs are subject to sun scald. Several years must elapse before fruiting wood can be developed.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. What six decisions are involved in the training and pruning of apple trees?
2. At what height should one-year-old apple whips be headed?
3. The system of training for apple trees should take into consideration what three factors?
4. What is the modified leader type of training?
5. Describe this type of tree.
6. Describe the pruning of young apple trees during their first few years in the orchard.
7. In pruning the young apple tree would you cut out all the fruit spurs developed on the scaffold limbs?
8. The time of year to prune will depend upon what considerations?
9. The amount of pruning will depend upon what considerations?
10. Have the most satisfactory results been secured by light pruning or by heavy pruning?
11. What are the effects of heavy pruning?
12. What are the effects of light pruning?
13. Discuss the renovation of old orchards.

SUGGESTED EXERCISES

1. Visit the orchards in the community and study the methods of pruning employed. Determine if the trees have been pruned according to the modified leader, the open head, or no definite system. Note whether or not heavy or light pruning has been practiced.

2. The teacher and the class should get permission from an orchardist to prune some trees. Each member of the class should prune some trees of different ages.
3. The class should prune young trees by contrasted systems. One portion of the trees should be headed back, while the other should be pruned by thinning out. The type of growth that results should be noted.

CHAPTER XIV

APPLES—CONTROLLING INSECTS AND DISEASES

Job 7—Controlling Apple Insects and Diseases

The fruit grower is interested in profits, and counts the degree of success of his undertaking by the amount of profit secured. In the chain of productive factors, the link of controlling insects and diseases is one of the most important. It is of extreme importance because it influences, to a great degree, the longevity and productivity of the orchard on the one hand, and on the other hand it influences the quality and condition of the annual fruit crops. The job of controlling apple insects and diseases requires the making of five decisions: (1) determining what methods to employ in controlling insects, (2) determining what methods to employ in controlling diseases, (3) how to prepare sprays, (4) when to apply sprays, and (5) what equipment is necessary.

Apple Insects.—The grower, in determining what methods to employ in controlling insects, will be guided by the type of insects present. There are two general classes of insects attacking the apple: (1) chewing insects, and (2) sucking insects. The chewing insects include those which have biting mouth parts and which, at least during some period of their life history, eat some exterior or exposed portion of the fruit or foliage. Such insects are killed by the application of insecticides known as "stomach poisons." The codling moth is an example of this type of insect. Sucking insects com-

prise those which have sucking mouth parts and obtain their food by sucking the juice from the plants upon which they feed. They are controlled by what is known as "contact insecticides"; that is, they must be covered with some spray which will kill them. Plant lice belong to this class of insects.

Apple Tree Borer.—There are two species of apple tree borers—the roundheaded and the flatheaded borers. The roundhead type is usually more destructive than the latter, but both are among the most important apple insects. They are most noticeably destructive on the young trees, where they do considerable damage if not carefully watched. Trees infested with borers often show discoloration of the bark under which the borers are working. Often the trees show small holes in the bark from which sawdust sifts out.

The roundheaded borer is yellowish-white with a dark head, cylindrical in shape, and about three-fourths to one inch long. It bores into the bark, making small round holes, and remains in the tree two or three years.

The flatheaded borer is usually found from the base of the trunk up to the limbs, and is more often on trees which have become weakened or diseased. It is waxy white in color and about an inch long, with a broad, flat head. This borer remains in the tree only one year before reaching the adult stage. It makes characteristic broad channels under the bark, which become shrunk and discolored.

The surest method of control of these borers is to cut them out with a sharp knife. All trees should be inspected twice a year, once in the spring and once in the fall, at which time all borers should be killed or removed.

San Jose Scale.—San Jose scale is probably the commonest and most injurious insect pest which attacks fruit trees in unsprayed orchards. It is a small, circular, lemon-yellow insect, covered with a greyish scale about the size of a pin head. When abundant these scales form encrustation on the branches. On the fruit each scale is surrounded by a reddish line or a red spot.

San Jose scale is controlled by spraying when the trees are in a dormant condition. Oil emulsion and commercial lime-sulphur are the common insecticides used for this spray.

Woolly Aphid.—The woolly aphid is distinguished by cotton-like masses on the bark, twigs, or roots. Inside of these masses one can find clusters of reddish-brown, soft-bodied plant lice. On the roots, galls are usually formed where these aphids feed.

The aphids which appear above ground can be controlled by spraying with a contact insecticide such as nicotine sulphate. To kill those present on the roots, remove the soil around each tree to a depth of three to four inches and spray with a solution of nicotine sulphate, or bury tobacco dust or tobacco stems over the roots. Cultivation and fertilization of the tree to induce a vigorous growth, so that the tree will be more able to withstand attacks of aphids, are desirable.

Codling Moth.—The grub of the codling moth is the chief cause of wormy apples. It is a whitish or pinkish grub about one-half to three-fourths inch long when full grown. The adult stage is a small moth which emerges in the spring and lays its eggs on the leaves. The eggs hatch and the young larvae enter the calyx end of the apples, usually soon after the flower petals have fallen. These worms remain in the fruit about thirty days, reach full size and come out to go through another

adult stage. There may be two or three broods of this insect during the summer. The codling moth is controlled by spraying with arsenate of lead. There are three important sprays for the control of this insect.

First—Calyx spray immediately after the petals fall and before the calyx becomes closed.

Second—Ten days to two weeks later.

Third—Usually eight to nine weeks after petals fall, the exact date depending upon the hatching of the second brood of worms.

Other Apple Insects.—The spraying program recommended for the pests already listed will generally be sufficient to control other insects which attack the apple.

Apple Diseases.—The grower, in determining what methods to employ in controlling diseases, will be guided by the types of diseases present.

Fire Blight.—This disease is often known as pear blight, because it attacks the pear. It is called blossom blight, twig blight, body blight, and blight canker, depending upon the part of the tree affected. The first sign of this disease is the wilting of the ends of twigs, or wilting of fruit spurs which have produced a cluster of blossoms. These soon turn brown. In a few days the leaves on adjoining limbs and spurs begin to die and the whole branch may soon be affected in a like manner. As the disease advances, it causes a discolored and blackened condition of the bark. When the affected area stops increasing in size, a distinct line will mark the border of the living and dead portions of the branch. This is known as blight canker.

Blight is caused by bacteria which work entirely inside the bark. Up to the present time, no absolute control for it is known other than that afforded by pruning

during the dormant season. Pruning during the growing season stimulates vigorous growth which is very susceptible to this disease. The pruning cuts also make



Courtesy of G. C. Starcher

A YOUNG APPLE TREE WELL SPRAYED

an easy entrance for the blight organisms into the tree. All affected parts should be removed, and also some of the area below the infection. All diseased portions should be burned. Following the removal of blighted branches, all wounds should be thoroughly disinfected to prevent spreading the disease to other branches and other trees. Bichloride of mercury about the strength of one part to a thousand parts of water is the usual disinfecting solution. This is poisonous.

Blotch.—Blotch is one of the most serious diseases on both the fruit and tree in the South. The disease not only reduces the quality of the fruit, but through its habit of growing on the twigs, causes damage by lessening the productivity of the branches. It also attacks the foliage, but not so severely as scab. The disease is first noticeable on the fruit where it appears in small star-

shaped black spots. These enlarge rapidly and the blackened area becomes more or less swollen, soon showing minute black pimples from which spores are liberated for the further spread of the disease. These black spots enlarge and run together, and as the apple increases in size, cankers appear.

On the twigs, blotch produces roughened areas called "cankers" that persist from year to year, producing spores from which the annual attacks of blotch have their source.

Since the disease has its source in the cankered twigs and branches, blotch control will come from cutting out all of these cankers that are observed when doing the annual pruning. Bordeaux mixture is used as a spray to control the disease on the fruit. This spray is applied about a month after the petals fall.

Bitter Rot.—Bitter rot is more common in the South than elsewhere. It shows up on the fruit first in pale, brown specks which later become larger, darker in color, and sunken. These rotting spots are characterized in appearance by more or less circular rings, one within the other. On the twigs or limbs the disease appears as oblong, irregular, sunken cankers, covered with cracked bark.

In winter, cut off the brown cankers and pick off all mummied apples. To control bitter rot on the fruit, follow the spray calendar given in this chapter. Bordeaux mixture is the spray material used in the control of this disease.

Cedar Rust.—This disease shows up as yellowish-orange spots on the leaves, and occasionally on the fruit. The effect on the tree is to cause it to become very much weakened due to the heavy leaf fall. The disease passes from the apple to the cedar on which it causes a growth

known as cedar apples. All new infection on the apple must come from the cedar trees, as the disease never spreads to apple trees from apple trees. To control this disease, cut out nearby cedar trees.

Scab.—Apple scab is one of the most important apple diseases. On the leaves the disease causes a small circle, or oval spots, and generally causes the leaves to fall prematurely. On the young fruit it produces at first small, circular, dark spots which form brown or dark corky spots, and which in severe cases, causes the fruit to crack open. Scab is most severe in wet, cool weather. The damage is two-fold in that it injures the fruit so that it is unfit for market, and in that it reduces the vitality of the tree to such an extent that productivity is lessened.

Apple scab is controlled by spraying with lime-sulphur or bordeaux mixture.

Sprays and Spraying.—Spray materials are of two distinct kinds or classes: (1) insecticides, or those sprays used for insect control; and (2) fungicides, or those used in the control of fungus diseases.

Insecticides are of two different groups—those used for the control of chewing insects, and those used for the control of sucking insects.

Arsenate of Lead: This is the best and most widely used poison for chewing insects. It adheres well to the leaves and does not injure the foliage. It also has the advantage of combining well in mixtures with other spray materials. The powdered arsenate of lead is the most popular form in use at the present time. In mixing arsenate of lead powder, the desired amount should be mixed with a small amount of water until it becomes a thin paste. Then it should be poured into the spray tank and diluted to the desired strength.

Lime-Sulphur: This is obtained on the market in a concentrated, liquid form for use in the orchard, and needs only to be diluted with the proper quantity of water. Lime-sulphur purchased in a liquid form on the market is known as commercial lime-sulphur. Lime-sulphur may also be made at home and under some conditions this is more economical than to buy the commercial product.

Nicotine, or Tobacco Extract: This is an important material in controlling such sucking insects as aphids. For this purpose it is used at the rate of three-fourths of a pint of nicotine sulphate to one hundred gallons of water or spray material. This material is known as nicotine sulphate, and is obtainable on the market by the trade names "Blackleaf 40," "Nicotine," and others. Such materials are to be preferred to home-made extract since the strength is always uniform.

Miscible Oils: These are contact insecticides. They are used only as a dormant or semi-dormant spray, to control San Jose scale. They are mixed with water for use and are easily applied and effective for that purpose.

Lubricating Oil Emulsion: Lubricating or engine oil emulsion is gaining much favor as a cheap yet effective dormant spray for the control of San Jose scale. This spray may be made at home or purchased from spray manufacturers. It is similar in its action and effect to the miscible oil sprays and has the advantage of being considerably cheaper.

Bordeaux Mixture: Bordeaux mixture is a fungicide. Modern spraying had its origin through the accidental discovery of the mixture now known as bordeaux. The mixture consists of a combination of copper sulphate, lime, and water in various proportions. In reading the

SPRAY CALENDAR FOR APPLES

No.	Name of Spray	Time of Application	Material to Use	Pests	Remarks
1	Delayed Dormant	When green can be seen in tips of blossom buds	Standard strength (32° Baume) concentrated lime-sulphur diluted 1 to 8. Add $\frac{3}{4}$ pt. nicotine sulphate to each 100 gals. of solution. Oil spray should be used if much scale prevalent	Scale Aphis	If orchard is badly infested with scale, an oil spray should be applied as delayed dormant spray with nicotine sulphate
2	Pink Spray	Begin when pink shows plainly in blossom buds	Standard strength (32° Baume) concentrated lime-sulphur. Dilute 5 qts. to 50 gals. of water	Scab Mildew	Spray all varieties susceptible to scab or mildew, especially if infected preceding year
3	Calyx Spray	When petals are fallen—stamens fall	Standard strength (32° Baume) concentrated lime-sulphur, 5 qts. to 50 gals. of water. Add $1\frac{1}{2}$ lbs. powdered lead arsenate to each 50 gals. of solution. Mix the lead with lime water before adding to tank	Codling Moth Leaf Roller Curculio Tent Caterpillar Scab Mildew	Do not omit this spray on any varieties. Very important in control of codling moth and scab
4	Ten-day Spray	Ten days after calyx spray	Same as Spray No. 2	Frog Eye, Scab Mildew, Blotch	This is important frog eye, blotch, and scab spray
5	Three-week Spray	Three weeks after calyx spray. Spray susceptible varieties first, then other varieties	Bordeaux Mixture 3-4-50 in rot susceptible orchards. Add $1\frac{1}{2}$ lbs. powdered arsenate of lead to each 50 gals. of solution. Mix lead with lime water before adding to tank	Bitter Rot Codling Moth Leaf Roller Scab Blotch Black Rot	Bordeaux used to control bitter rot in place of lime-sulphur. First brood of codling moth controlled by this spray
6	Six-week Spray	Six weeks after calyx spray	Bordeaux Mixture 3-4-50	Bitter Rot Blotch Black Rot	Apply to rot susceptible orchards or where rot or blotch was prevalent the preceding year
7	Nine-week Spray	Nine weeks after calyx spray or three weeks after six-week spray	Bordeaux Mixture 3-4-50. Add $1\frac{1}{2}$ lbs. powdered arsenate of lead (with lime water) to each 50 gals. of solution	Codling Moth Leaf Roller Bitter Rot Black Rot Blotch	This spray is important in codling moth control (second brood) and in control of leaf roller

Do not add lead arsenate directly to lime-sulphur, mix the lead with two pounds of lime for each pound of lead arsenate. Lime-sulphur applied during cracked-egg stage of aphids effective, but will give no control after eggs have hatched. Nicotine sulphate should be added at this stage.

Early emulsions will not control aphids in cracked-egg stage, but if this application is delayed until eggs hatch, the oil with nicotine added is effective in cracked-egg stage of aphids lasts over a period of two weeks.

Do not use sulphur in emulsion liquid lime-sulphur where the latter is not available.

Spray No. 1 and No. 2 should not be omitted from Delicious, Winthrop, Stayman, Virginia Beauty, Mammoth Black Twig, and Limbertwig varieties as these are very susceptible to scab.

formula for making bordeaux, the first figure refers to the amount in pounds of copper sulphate, the second figure to the amount in pounds of lime, and the last figure to the amount in gallons of water used in the mixture. To make bordeaux mixture it is most convenient to make up a stock solution of copper sulphate by dissolving the crystals in water at the rate of one pound to one gallon. This is most quickly done by suspending the crystals in a sack just beneath the surface of the water. In preparing the stock solution of lime, a small proportion of lime and water is used. Fresh stone lime is weighed out and placed in a barrel. It is slacked by adding slowly small amounts of water, not enough to cover completely, but enough to keep it from burning. After the lime is crumbled and entirely slacked, cold water is added—one gallon for each pound of lime. Hydrated lime is often used as a substitute for stone lime because of its greater convenience in making up the lime solution.

To make bordeaux mixture from the above prepared stock solutions, stir the liquid well in each barrel and take out the number of gallons of each as found called for in the formula. The two solutions should never be mixed together before either the lime or copper sulphate is in a diluted form. In preparing bordeaux mixture pour the required number of gallons stock solution of copper sulphate in the spray tank, run the tank two-thirds full of water, add the number of gallons of lime solution called for by the formula, and complete the filling of the tank, keeping the mixture constantly agitated. Mixing bordeaux in this way makes for a fine suspension spray.

Commercial Lime-Sulphur: Commercial lime-sulphur is used as a fungicide for most of the diseases attacking the apple. When used as a fungicide for

apples, it is generally mixed at the rate of 5 quarts to 50 gallons of water. A more accurate way of dilution is to test the lime-sulphur with a hydrometer and mix according to the dilution table.

In spraying, most growers follow a definite spray calendar. The spray calendar on page 164 is recommended by several southern institutions and is used by a number of successful growers.

Spraying Equipment.—The equipment that the grower should select to do the spraying will depend upon (1) the size of trees, (2) the number of trees, and (3) the topography of orchard. The following points are the chief essentials of a good spray outfit: (1) pressure—the importance of high pressure for obtaining a mist-like spray cannot be over-emphasized; (2) agitation—all spray mixtures, to obtain the best results, must be constantly agitated; (3) engine—the construction of the engine should be simple so that it may be operated by the fruit grower without trouble; (4) pump—the importance of a good pump is equal to that of a good engine, it should be capable of maintaining a high pressure without running the engine at more than normal speed; (5) the nozzle should be of a type which will not clog easily and may be readily cleaned, nozzles of a disk type are desirable because they give a fine misty spray; and (6) hose and rods—strong spray hose should be used, not less than five-ply.

A barrel can be used if the orchard is small. However, it is difficult to obtain high pressure with this small pump. For an orchard of two to six acres, a spray tank mounted on a light wagon with a large double-action, horizontal pump will be more satisfactory than the barrel sprayer. If the orchard is over six acres in size, a good power sprayer will be necessary. In a large com-

mercial orchard, a power sprayer is required for each 25 or 30 acres of trees.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. In what way is the factor of controlling apple insects and diseases so important?
2. The control of apple insects and diseases requires the making of what decisions?
3. What two general classes of insects attack the apple?
4. Distinguish between these two classes.
5. Name the important apple insects.
6. Describe the apple borers.
7. How do you distinguish woolly aphis?
8. What is the codling moth and how is it controlled?
9. What are the principal apple diseases?
10. Describe fire blight and its control.
11. Describe blotch.
12. Spray materials are of what two distinct kinds?
13. Insecticides are divided into what two groups?
14. Fungicides are of what two classes?
15. What is the most widely used poison for chewing insects?
16. What is the principal insecticide for sucking insects?
17. What material is generally used for controlling aphids?
18. Lubricating oil emulsion is generally used for the control of what insect?
19. Describe the making of bordeaux mixture.
20. When commercial lime-sulphur is used as a fungicide for apples, what strength is employed?
21. Upon what factors does the type of spraying equipment depend?
22. What are the chief essentials of a common spray outfit?

SUGGESTED EXERCISES

1. Visit nearby orchards and study the spray materials used, the type of spraying equipment present, and the spray schedule employed.
2. Determine what are the principal apple diseases and insects in your community. Collect specimens for the laboratory from community orchards and study these until you can identify them.
4. Visit old, run-down orchards and note the injurious effects of the ravages of different diseases and insects.
5. Secure small quantities of the different insecticides and fungicides from spray manufacturers. Become acquainted with the characteristics of each of these.
6. Make up mixtures of lime-sulphur solution and bordeaux mixtures.
7. Write to the state agricultural college and secure spray calendar for spraying apples.

CHAPTER XV

APPLES—HARVESTING AND MARKETING

Job 8—Harvesting Apples

The question of marketing is one of the most important considerations in successful fruit growing. It is not sufficient that the grower shall spray, prune, and give other cultural practices to his orchard in order that high-class fruits will be produced, but he must familiarize himself with the best methods of marketing if the crop is to be sold in the most satisfactory manner. The question of marketing apples includes the jobs of harvesting the crop, preparing it for the market, storing, and actual selling or marketing.

The job of harvesting the crop involves two decisions:

- (1) what equipment is necessary for harvesting, and
- (2) when and how fruit should be picked.

Equipment.—Picking equipment consists of ladders, picking receptacles, containers to carry fruit from orchard to packing place, and wagons or trucks for hauling.

With trees of any size some type of ladder will prove very useful. There are two types of ladders that are especially valuable in this connection. One is a step ladder with three legs, one leg in front which enables the picker to get into the tree easily and to establish it firmly on the ground more quickly. For trees of large size the pointed top ladder is best. The two side pieces in this ladder come together at the top, making it

pointed. This makes it much easier to use in trees than the usual type of ladder.

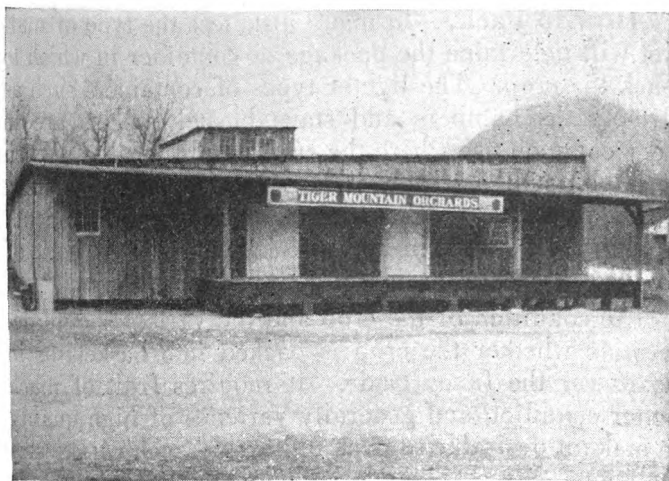
Picking receptacles include smooth oak-staved baskets, galvanized iron pails, and various forms of metal and cloth picking bags. The three former types are quite satisfactory. The cloth picking bags are very objectionable in that the fruit is readily bruised.

Containers for carrying the fruit from the orchard to the packing place vary in different sections. Many orchards use the oak stave picking basket for this purpose also. It is very satisfactory, but a considerable cash outlay is necessary because of the number of containers required. Various forms of crates and lug boxes are successfully employed in many sections. When this type is used a kind should be selected which reduces the bruising of the fruit to a minimum.

Wagons for transporting the crop from the orchard should be equipped with bolster springs so as to reduce the amount of jar to the fruit. Wide, specially constructed beds or frames are placed upon the wagon frame to enable the crop to be hauled without undue stacking of one container above the other. Sometimes double decked frames are used for this purpose.

Picking.—Apples should be picked as soon as they are mature. Maturity in most instances means hard-ripe and not eating-ripe. As a rule, over-maturity is more disastrous than immaturity, though both conditions are to be avoided. The proper degree of maturity is decided in various ways: (1) red color and ground color, (2) separation from tree, (3) color of seed, and (4) tendency to drop. In many cases the amount of red color is frequently a fair index. In the case of red apples, the ground color which underlies the red color or blush is the most reliable indication of maturity.

When the apples are ready to pick, the ground color should have turned to a white or a very light yellow. In immature fruits this color is green. The ease with which the apple separates from the spur is one of the most valuable guides in determining the time to pick. So long as either the stem or the spur breaks instead of the joint between the two, the apple should be left on the tree. When this joint separates readily it is generally a good time to pick. The seed show a good brown color as a rule before the apple is ready to pick.



Courtesy of R. D. Massee

APPLE PACKING HOUSE

Some varieties have a tendency to drop before maturity, especially during windy weather. The grower should watch these varieties closely and when dropping starts, picking should begin immediately.

In picking the crop care should be exercised not to destroy the fruit spurs. If the thumb is placed beside the joint between the stem and the spur and then the

apple is pushed toward the thumb with a quick motion, the joint will usually break easily. Apples should always be picked with stems attached.

Job 9—Preparing the Crop for Market

The job of preparing the crop for market requires four decisions: (1) how to pack, (2) how to grade, (3) type of packing house to use, and (4) what equipment is necessary.

How to Pack.—In many instances the type of market will determine the package or container in which to pack the crop. The lighter types of containers such as five-eighths hampers and stave bushel baskets are in very common use where the crop is sold locally. When it is shipped, however, it is packed in either barrels, boxes, or bushel baskets. Much of the fruit in the South is shipped in bulk in cars. Generally this is fruit of low quality but even then it is to be discouraged.

The condition of the crop and the variety should determine whether the crop is packed into baskets or in boxes for the fancy trade. It requires fruit of much better condition and generally varieties of high quality to make it desirable to pack in boxes. Such varieties as Delicious, Winesap, and Stayman, if the condition is good, should be packed into boxes to get the best prices. Varieties such as York, Ben Davis, and Limbertwig are better handled in baskets because of their lower quality.

The labor available also influences the type of package used. There are some sections in the South in which apples are grown where good box packers are not available. Where such labor cannot be secured it may be necessary to pack high quality fruit in packages that require less skill in packing. The box is now rapidly

coming into favor in the East and South although it has long been a standard package in the West. Boxed apples of high grade and uniformity with attractive packing have generally commanded a much better price than apples sold in any other style of container. The mechanics of packing are largely centered around insuring



Courtesy of R. D. Massee

INTERIOR OF APPLE PACKING HOUSE

safe delivery of the fruit and giving it an attractive appearance.

Grading.—If the crop is to be sold in bulk, much less grading will be required than where the crop is to be sold in boxes. If the crop is of good quality and relatively free from insects and diseases it will require less work in grading than where the crop is heavily infested with insects and diseases. The quality of the grading depends naturally upon the type of labor em-

ployed. Experienced, careful labor will be able to grade the fruit more rigidly than inexperienced help. Sizing, or dividing the crop into uniform sizes, is generally done in large orchards by machinery. If sizing is not done by machinery, it is generally done along with the grading and packing operation. It is well for the orchardist to become acquainted with the Standard Grades for Apples issued by the United States Department of Agriculture, and to grade his fruit accordingly.

The Apple Packing House.—The type of packing house to use will depend upon the size of the crop and system of packing.

With a small crop it may not be necessary to build a packing house, as some building on the place may be converted into a packing house or some other building may be used temporarily for this purpose. If the crop is of any size it will be of advantage to have a packing house. In cases where the fruit is packed cooperatively, the packing house will not be needed if the fruit is packed at a central packing house.

The type of package to be used also influences the need of a packing house. Growers who ship their apples in bulk or who sell locally do not need a house. Some growers perform their packing operations in the orchard. In building a packing house there are several points that should be kept in mind: (1) the house should be of sufficient size to handle the crop without crowding the floor space with fruit so that the workers do not have sufficient room to perform their duties properly; (2) the house should be so constructed that it is well lighted: plenty of light is essential in performing the operations of grading and packing; and (3) the house should be so located and arranged that the fruit moves in one direction in an orderly manner. It should

move across the house to the car or to cold storage.

The packing house should be located on the railroad or on a good road. It is profitable to have a site where the fruit may be lowered directly from the house into cars. The house should provide ample space for empty containers. This is commonly provided by a loft overhead with shoots for delivering the containers to the first floor. Storage space should be provided for loose fruit so that the operation of the house is not dependent upon daily pickings. There should be storage space for picked apples. Receiving platforms should be built at convenient heights so that the wagons or trucks transporting the loose fruit from the orchard may be readily unloaded.

Equipment.—The type of equipment for a packing house will depend very largely upon whether baskets or boxes are to be used for containers. In either case the type will depend somewhat on whether or not machinery is to be used in those places where it can displace hand labor. The modern packing house is generally equipped with grading belts or rollers, conveyors of different descriptions, mechanical sizers, and packing benches. Where only a small crop is to be handled, packing tables may take the place of grading belts and machinery, but if much of a crop is to be packed it can be done more rapidly if grading and sizing machinery is provided.

The arrangement of the equipment in the house should be such that the fruit moves in one direction as each operation is performed. Equipment should be so arranged that there is plenty of working space and where the best light is placed on the grading and packing operations. The mechanical sizer is growing in popularity but is not in use by all growers. It is generally felt that such equipment is profitable only when

the crops amount to 5,000 bushels or more. Anything less than this amount is generally handled with the ordinary canvas- or burlap-top tables.

Job 10—Storing Apples

The job of storing apples requires three decisions on the part of the grower: (1) whether or not to build a storage place, (2) type of storage to build, and (3) how to operate the storage house.

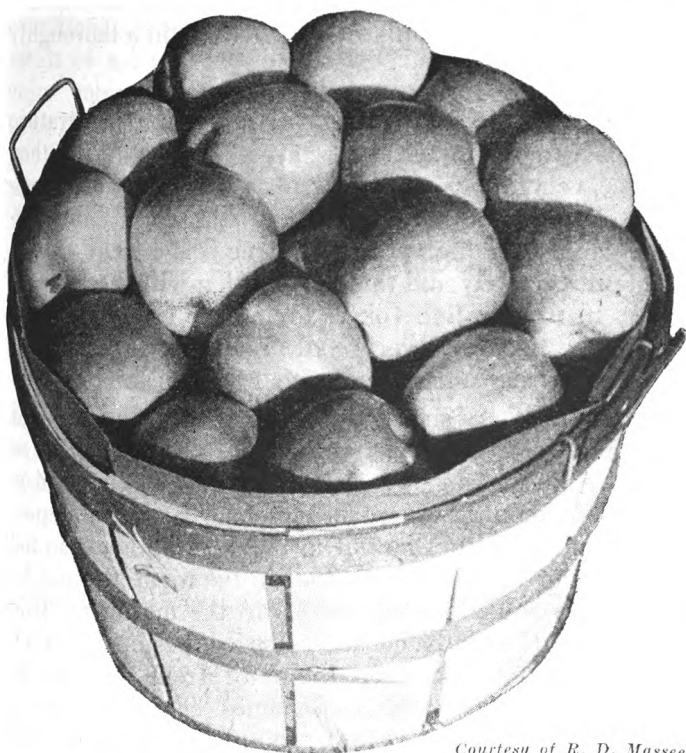
Whether or Not to Build Storage.—A storage house should not be constructed unless there is an annual need for it. If cold storage facilities are available nearby and the rates are reasonable, it would certainly pay to take advantage of the situation. Some growers find it desirable to ship their crops to the terminal markets and store there. If their market is a distant one, it will probably be better business to do this rather than to build and operate their own common storage. Where local cold storage is available the comparative costs between it and common storage should be considered.

If the fruit is marketed through the period of a year and no cold storage facilities are available, it will generally be highly desirable to build a common storage if conditions are such in the section that common storage is successful.

The Type of Storage.—Common storage can never supplant cold storage, and neither is it as efficient as cold storage. However, it serves an important need as an economical, temporary method of prolonging the marketing period of apples. Some seasons it will be much more satisfactory than others.

The two main points of consideration in the construction of a common storage are ventilation and insulation.

It is necessary for undisturbed circulation of air in a common storage house to cool the large mass of warm fruit that is put into it. This circulation and an abundant amount of air is provided by ventilators in the floor



Courtesy of R. D. Massee

A HALF-BUSHEL BASKET OF RED DELICIOUS APPLES

known as vents, and ventilators in the top of the house through the cupola. These vents are so arranged that the intake of air may be regulated. The house is constructed with false floors which aid greatly in facilitating the free circulation of air.

Double walls or hollow walls with air spaces between are generally used to produce insulation. Best results are secured if the air spaces between the walls are filled with cork or mill shavings. Sawdust is objectionable because of the moisture it contains. If mill shavings are used, they should be placed in the walls in a thoroughly dry condition.

Operation of Storage House.—The temperature that prevails in early fall at harvest time and from then on is a very important factor in influencing the successful keeping of apples in common storage. If the temperature is very high at harvest time it is difficult to cool the fruit properly and to an extent that will check ripening. In preparation for receiving the crop advantage should be taken of every cool night to reduce the temperature of the storage house as low as possible.

The ventilators should be opened after sundown, and the whole house closed tightly before sunrise, so as to keep out the warm day air. Each day, as the fruit is picked, it should be kept in the shade as much as possible. It should not be put in the packing house in the evening but left outside to cool in the night air, and be put in the house before sunrise in the morning. This practice will greatly conserve the cool temperature of the house and also keep the fruit from sweating in storage. As the weather becomes cooler advantage should be taken of it to lower the temperature and cool the fruit as much as possible. When all the fruit is in the house it should be opened as little as possible and the fruit left wholly undisturbed. After the fruit is stored, open the house only at night.

In an air-cooled storage, it is, of course, not possible to maintain as low a constant temperature as under mechanical refrigeration, but the fruit should be kept as

cool as possible without freezing. Apples are generally stored at a temperature from 34° to 36° F.

Two other factors influencing the success of storage are handling the fruit and maturity of fruit. The skin of the fruit must be preserved in a sound, unbroken condition. Much of the decay in storage occurs as a result of a broken skin followed by blue mold, which gains entrance through skin injuries. Fruit that has been allowed to stand in the orchard in the hot sun for any length of time deteriorates rapidly. Apples picked too green have a tendency to develop scald in storage. Apples that are too ripe do not hold up as well as if picked just the right time.

Job 11—Selling the Crop

The job of marketing or selling the crop requires six decisions on the part of the grower: (1) whether to sell individually or cooperatively, (2) when to sell, (3) where to sell, (4) how to sell, (5) whether or not to use shipping point inspection, and (6) what use to make of crop and market statistics.

Individual vs. Cooperative Selling.—A great many growers will not have the opportunity of selling their apples cooperatively because of the absence of such an organization in their immediate section. It might be well for them to consider, if there are other growers in the section, the advisability of forming a selling organization. If there is an organization in the section, the advisability of joining it will depend largely on the type of organization and its success. The day of the individual fruit grower operating as an individual is fast passing and the necessity for group action is increasing. Where there is the right type of organization

present a grower will generally be acting wisely to use it. If the organization is weak and it is not possible to reorganize it on the right basis, a grower with experience and training had probably better do his own marketing for the time being.

The grower, in any event, should fully acquaint himself with the fundamental principles of successful organizations.

When to Sell.—If the crop in the grower's section and throughout the country is large, it may pay him to hold the crop until winter or spring. This is not true always. Frequently many growers store with the result that a more satisfactory price could have been secured at harvest than at a later time.

If the grower sells his crop on the general market it will require much judgment regarding the best time to sell. If he is supplying a local market, it is generally advisable to distribute his crop as much as possible throughout the season. Many growers are forced to sell their crop immediately after harvest because of lack of capital with which to hold it. Other growers find it advisable to sell their crop immediately after harvesting and packing because of the lack of storage facilities.

Where to Sell.—The grower who is producing only for the local market will either have to sell his product on the local market or to buyers who come direct to the fruit farm. But if the grower is a commercial grower, he will either sell locally or ship to one of the larger markets.

How to Sell.—If the apples are not sold through a cooperative association, they are sold on consignment or to cash buyers.

Selling on consignment has met with much criticism,

but nevertheless many growers have practiced it with entire satisfaction. There are many commission firms of the highest integrity. A grower should carefully investigate the standing of the firm with which he expects to do business.

Selling to cash buyers or f. o. b. is desirable. Most cash buyers buy for an established trade and provide a very satisfactory outlet. The lump-sum and tree-run buyers are a factor in the apple business. However, the higher type of fruit growers are interested in building a reputation for their own brand and only in rare instances use this outlet for their crop.

The selling of the crop should be handled in a strictly business way. There should be a contract between the producer and the buyer. The contract should clearly state (1) the price and how paid and (2) the grades.

Shipping Point Inspection.—If the crop is to be sold on the local market or to a local buyer, it may not be necessary to have shipping point inspection; but if the fruit is to be shipped to a distant market, the grower will find that it pays. Such an inspection is of great value to the grower in establishing the conditions of the car, the grade of the fruit, and the certificates of prima facie evidence in court. Such inspection thus places responsibility for deterioration in fruit upon others than the grower after it leaves his possession.

Crop and Market Statistics.—To secure the best results a grower should be fully informed in regard to crop and market statistics. Various agencies of the United States Department of Agriculture, notably the Bureau of Agricultural Economics, issue reports dealing with crop estimates, markets, and storage that are invaluable to the grower. The need for reliable crop forecasts is imperative in giving the grower some idea in

regard to the price which he may reasonably expect for his crop. Market reports, showing the point of origin and the destination of apples, are of great value in enabling the grower to secure the best distribution of his crop. The Market News Service reports of the Government are valuable in this connection and in keeping the grower informed in regard to price fluctuations and market conditions in the different sections of the country.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. The harvesting of apples involves what two decisions?
2. The equipment for harvesting apples depends upon what three considerations?
3. Give a list of equipment commonly used in harvesting apples.
4. Describe a convenient form of ladder to be used in picking apples.
5. What two types of picking receptacles are most satisfactory?
6. What three considerations determine when apples should be picked?
7. How is the proper maturity for picking apples indicated?
8. Should the apples be picked with the stems attached or not?
9. In preparing the crop for market what four decisions are necessary?
10. What determines the method of packing apples?
11. Which type of container brings the best prices?
12. What considerations determine the amount of grading necessary?
13. The type of packing house to use will depend upon what factors?
14. In building a packing house what are the main points to consider?

15. The modern apple packing house is generally equipped with what equipment?
16. Storing apples requires what three decisions on the part of the grower?
17. Whether or not to build an apple storage will depend upon what considerations?
18. Is common storage as efficient as cold storage?
19. Name the two most important considerations in the construction of the common storage.
20. How is ventilation provided in the common storage house?
21. How is insulation provided in the common storage house?
22. The successful operation of a storage depends upon what factors?
23. Discuss the operation of a common storage house?
24. What other factors influence the success of apple storage?
25. Marketing the apple crop requires what decisions on the part of the grower?
26. What considerations govern the time of selling?
27. What factors govern where the grower will sell his crop?
28. What factors determine how the grower sells?
29. What different methods of selling are used by apple growers?

SUGGESTED EXERCISES

1. Visit local orchards and study methods of picking, type of equipment used, methods of grading and packing, type of containers used, type of packing house, type and arrangement of equipment, and when apples are ready for picking.
2. Secure apple boxes together with supply of fruit and acquire skill in packing.
3. Write the United States Department of Agriculture for United States grades for apples.
4. Draw plans for an apple packing house and indicate arrangement of equipment in it.
5. If there be any types of common storage houses in the community, study their construction and operation.

6. Make a survey to determine by what methods apples are sold by orchardists in your community.
7. Write to the United States Department of Agriculture for copies of Market Reports and to your State Department of Agriculture for Crop Statistical Reports that they may issue.
8. In the farm shop make ladders and other equipment for harvesting apples.

SEASONAL OPERATIONS IN THE APPLE ORCHARD

January, February, and March

Spray for San Jose scale with lime-sulphur solution or with lubrication oil emulsion. Prune the trees. Transplant young nursery trees to missing places in the orchard if this could not be done in the fall. Repair all tools and equipment. Put all machinery in first-class condition. Make plans for all seasonal operations.

April, May, and June

Cultivate the orchard thoroughly as the blossom buds are bursting. Spray for the control of scab, codling moth, blotch, and the different fruit rots. Apply nitrate of soda about the time the buds are swelling, and the other fertilizer as soon as the crop is set. Thin fruit.

July, August, and September

Cultivate continuously. Apply the correct summer sprays. Sow soybeans or cowpeas in rows between the trees. Order picking equipment and supplies. Organize for harvesting the crop. Clean both packing house and storage house. Start picking early varieties. Sow winter cover crop.

October, November, and December

Harvest fruit. If winter cover crop has not been planted previously, sow it now. Pack and market fruit crop. After harvest and packing has been completed, store away equipment used for these operations. Order nursery catalogs and nursery stock. Prepare land for orchard planting. Plant trees.

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CHAPTER XVI

PECANS—SELECTING THE LAND

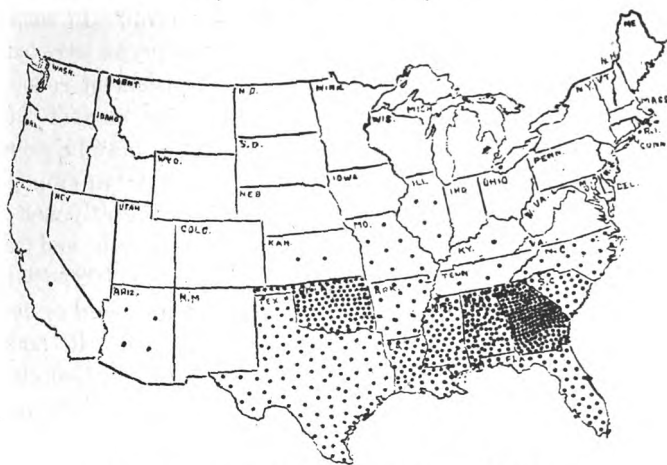
Job 1—Selecting the Land for Pecans

Pecan growing is an industry that fits in well with general farming. In recent years the pecan has become one of the money crops of the South. If a farmer lives outside of what is known as the commercial pecan belt, he had better confine his efforts at pecan growing to a few acres near the house as a side line; but if he lives in the great commercial pecan region, he may well consider planting part of his land to pecans as a money crop.

Range of Pecans.—Pecans have been planted and thrive from the Atlantic Coast to the western part of Iowa, Oklahoma, and West Texas; and from the 39th parallel on the north to the Gulf on the south. In addition, successful trial plantings have been made on the Pacific Coast, especially in California. However, the large commercial plantings are found only in the southeastern states, Texas and Oklahoma.

The states ranked according to number of orchards planted to improved varieties are Georgia, Florida, Alabama, Mississippi, Louisiana, South Carolina, Texas, and Oklahoma. In Texas and Oklahoma there are still to be found large forests of native pecan trees that put these states in the first rank as pecan nut producers. The chief pecan areas of the United States are found on the accompanying map.

Pecans as a Side Line.—Farmers in general would do well to plant a few pecan trees about their premises, both as shade trees and for producing nuts for food. As a shade tree, the beauty of the pecan is unsurpassed, and this alone would justify its being planted near the home.



PECAN PRODUCTION IN THE UNITED STATES
Each dot represents 100,000 pounds.

These plantings may be extended to cover a few acres near the house and serve the family as one of the pin money crops together with surplus butter, eggs, honey, and fruits of various kinds. The pecan is not a quickly perishable product and there is always a good sale for the surplus in the nearby markets, especially at Thanksgiving and Christmas.

The number of trees to plant as a side line may vary from one to fifty or more. These should be set only on good soil, not on poorly drained or very infertile soil not adapted to other orchard crops. The same cultural practices followed in a commercial pecan orchard will

apply to these small numbers of trees grown about the premises.

The Pecan as a Money Crop.—During the last 25 or 30 years an increasing number of farms in south Georgia, Alabama, north Florida, and South Carolina have been set to pecans as a money crop. In some instances the entire farm has been set to pecan trees but as a rule, the pecans are used to supplement cotton, tobacco, peanuts, or sugar cane. Some idea of the growth of the pecan industry in ten years may be gathered from the fact that during 1909 the pecan crop of the United States was estimated at 9,890,769 pounds. In 1919 it was estimated at 31,808,548 pounds, and the average annual production for the period 1927-1931 was 56,222,000 pounds, which includes the wild or uncultivated crops from Texas and Oklahoma. Its rank as compared with other horticultural crops in Georgia, Alabama, Florida, and South Carolina, where there are no wild trees, is shown in the following table:

<i>State</i>	<i>Pecans (lbs.)</i>	<i>Peaches (bus.)</i>	<i>Apples (bus.)</i>
Alabama.....	1,179,735	1,083,142	577,356
Florida.....	1,025,673	148,006	139
Georgia.....	2,544,377	4,788,718	416,902
South Carolina.....	525,783	389,734	215,659

Before launching into pecan growing on a large scale the grower should consider the number of years before he will get any returns from his orchard and also the amount of capital it will require to plant and care for the trees until they begin bearing.

Capital Required to Bring Pecans into Bearing.

—It takes from eight to ten years and a total of from \$200 to \$400 to the acre to bring a pecan orchard into bearing. This estimate does not take into account the interest on the investment, but includes the price of land,

trees, labor, fertilizers, etc., necessary for the proper care of the orchard. For this reason the grower will have to rely upon other money crops altogether, for the first ten years, for the farm income.



Courtesy of G. C. Starcher

A COMMERCIAL PECAN ORCHARD

After the pecan trees reach the bearing age they become of increasing importance each year, which enables the grower to gradually decrease his other money crops.

Returns to Be Expected from a Pecan Orchard.

—By the tenth year the trees should each be producing from 12 to 15 pounds of nuts. Taking the lower figure and valuing the nuts at 20 cents per pound, an acre containing 20 trees will return \$48 for what might be called the initial crop. On this basis, the orchard should produce an average of \$80 an acre for the next five years, and for the next seven years following this five-year period it should produce an average of about \$216 per acre each year. It should be remembered, that the income from a pecan orchard, just as with other horticul-

tural crops, will necessarily vary with the number of crop failures and the care given the trees.

Climatic Adaptations.—The pecan is adapted primarily to the South and to those sections of the country with a mild climate. It begins growth and blooms late in the spring and is not likely to be caught by late spring frosts. Practically all varieties now grown in commercial quantities require from 225 to 250 days of growing season to develop the crop, and unless the climatic conditions afford such a growing season the section is not likely to be well adapted to the commercial culture of pecans. Thus it will be seen that mountainous sections, even in the South, may have climatic conditions unsuited to growing pecans on a commercial scale.

Soil Requirements.—Where climatic conditions are suitable to pecan growing, the tree adapts itself to a very wide range of soil conditions. It thrives well on the different types of upland sandy loam and clay loam soils of the southeastern states adapted to the growth of cotton, corn, and oats. The fertility, humus, and moisture content of the soil are more important factors than the soil type in pecan growing. The pecan requires (1) a well-drained soil and (2) one that is deep and fertile or capable of being made fertile, whether it is upland or bottomland. It should be of the type that will retain its fertility and not wash. The pecan is acid tolerant and thrives better on a soil slightly acid than on one neutral or slightly alkaline. However, very sour soils should be avoided. Wet "crawfishy" lands where stagnant water stands just below the surface are unsuited to pecans. The pecan grows well along the banks of streams which frequently overflow. However, careful observations will show that such locations are considerably above water level except during flood stages of the stream and

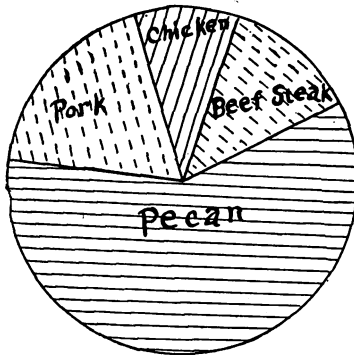
are capable of supporting numerous other species of plants not at all water-loving or aquatic in nature. Where gum and willow trees thrive the pecan is out of place.

Cut-Over Lands for Pecans.—Newly cleared land is likely to contain too much acidity or sourness for the successful growth of young pecan trees. It is also expensive to remove all the stumps from such lands when they are first cleared. It is preferable that cut-over land, from which the merchantable timber has been removed, be cleared of the young trees and planted to some cleanly cultivated annual crop for at least two years before planting the pecan trees. Two crops of corn and velvet beans or cotton grown on such newly cleared land will reduce the acidity and get the land in good condition for a pecan orchard. The yields of crops are usually very small on land the first year after it is cleared. But the crop should more than pay the expenses of culture the second year. A quicker reduction of the acidity may, of course, be accomplished by liming the soil with about 2,000 pounds per acre of hydrated or common builders' lime.

Setting Trees on Cut-Over Land.—Where the grower has nursery trees ready to set out, and is willing to cope with unfavorable conditions, he may set his pecan orchard as soon as the land is cleared. By this method, strips of land where the rows of trees are to be set are well broken as long in advance of the planting as possible. When the holes are dug for the pecan trees along these strips, extreme care should be taken to avoid pieces of decaying roots and limbs of forest trees remaining in or near the holes as they are liable to harbor wood lice which will later attack the young pecan trees. As time permits, the strips of land between the rows of

pecan trees should be broken and the sprouts from the stumps of forest trees should be cut as they appear so as to hasten the decay of the stumps. When the grower decides upon this rather crude method of starting a pecan orchard he should be in a position to give the trees rather close attention for at least the first two years.

Soils Unsited to Pecans.—There are three soil types or conditions to be avoided. First, soils low in humus content and lacking in fertility and moisture-holding capacity should not be used for pecans unless they can be improved and maintained economically. Deep, porous, sandy soils can sometimes be built up to support the growth, but the expense of maintaining orchards on such soils is likely to exceed the value of the orchard. With the first neglect in the soil building program on such lands the pecan trees are likely to rosette and sooner or later abandonment becomes necessary.



THE RELATIVE AMOUNT OF FAT
FOUND IN FOUR COMMON FOODS

Second, pecans should not be planted on badly washed or eroded hill-sides, not in cow pastures where no culture is to be given.

Third, occasionally a soil type is found which, apparently, is suitable to pecans but contains an impervious subsoil entirely unsited to this tree. Lands which support only small scrubby forest trees are to be avoided

for pecan plantings. *As a general rule, lands for pecan*

orchards are to be avoided unless they are capable of producing a half bale of cotton or from 30 to 40 bushels of corn per acre during a normal season.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Under what conditions should pecans be grown as a sideline? As a chief money crop?
2. On the accompanying map find the states or parts of states where pecans can be planted as a money crop. Where should they be planted as a sideline?
3. Why do Texas and Oklahoma rank so high in pecan production?
4. Why should home owners in general plant pecan trees about their premises?
5. What should be the number of trees planted as a sideline and on what kind of soil should they be planted?
6. Can you name any farmers who are planting pecans as a sideline? Where are they planted?
7. What is the number of his trees? What success has he had with the sale of nuts?
8. In what sections of your state are the commercial pecan orchards? How large are they? What other crops are planted on the farms?
9. What was the increase in pecan nut production in the ten years from 1909 to 1919? 1927-1931?
10. How do pecans rank as a horticultural crop in your state as compared with peaches? With apples?
11. How long does it take a pecan orchard to come into bearing?
12. How much are the total expenses for an acre before it comes into bearing?
13. What returns can the farmer expect from his pecans? If he has three acres set to pecans what will his returns be for the fifteenth year? For the twentieth year from a 50-acre orchard?

14. What age are the pecan trees in your neighborhood? Find out how many pounds of nuts they bear to the tree for an average year.
15. How many days of growing season do the commercial varieties of pecans require?
16. How many days of growing season has the section in which you live?
17. What are the soil requirements for pecans?
18. How should cut-over lands be treated before being set to pecans?
19. What is the method of setting trees on cut-over land?
20. What type of lands are unsuited to pecans?
21. Are there locations in your neighborhood suited to pecans? Are there any that are unsuited?

SUGGESTED EXERCISES

1. Using prevailing farm land values in your community and the prevailing prices of labor and pecan nursery trees, calculate the costs of establishing and maintaining a pecan orchard through the first five years.
2. From the information given in the text relative to soil requirements, determine the number of acres on your home farm adapted to pecan growing.
3. Make a careful study of pecan growing in your community and use the experiences of the local growers as a basis for your class discussions.

CHAPTER XVII

PECANS—SELECTING TREES FOR PLANTING

Job 2—Selecting the Trees

One of the most important jobs for the prospective pecan grower is the selection and purchase of suitable trees. Before deciding upon the varieties to plant he should find out the varieties best adapted to his section, and also whether or not he should plant one or more varieties. Many growers have discovered too late that they have varieties of nuts which do not fill out well in their section. Others find that they have planted large areas to a single late blooming variety when they should have interplanted with an early blooming variety to serve as a pollinator. Consequently, they learn when it is too late that the trees bear poor crops of nuts because the flowers were not adequately pollinated. Some varieties are very susceptible in certain sections to scab, a disease of pecans, and these should be avoided. Again, grafted trees suffer more from winter injury, in the northern portion of the southern pecan belt, and should be supplanted with budded trees which are seldom injured. These problems should be considered carefully before the trees are bought.

Two Groups of Varieties of Pecans.—An examination of the end of a branch of a blooming pecan tree will reveal two types of flowers. The long tassel-like blooms that develop from last year's buds are the staminate flowers and are called catkins. They produce the pollen. When these catkins are fully developed, the

faintest breeze will blow a cloud of pollen from them.

The group of flowers at the *terminal* of the *new growth* are the pistillate flowers. From these the nuts develop. The pollen from the catkins, falling upon the pistillate flowers while their pistils are yet sticky or when they are at the proper stage of development, fertilizes the flowers and nuts result. If these pistillate flowers are not fertilized they dry up and drop off without developing nuts.

On the basis of the characteristics of the catkins, all varieties of pecans can be divided into two groups, the *early bloomers* and the *late bloomers*.

Early Blooming Group.—In the early blooming group, comprising such well-known varieties as Alley and Pabst, the catkins in the bud are inclosed in broad bud scales. When the catkins push out from the bud they are rather short and thick. The catkins shed their pollen at about the same time the pistillate flowers are receptive, i. e., in the proper stage to be pollinated, and consequently, these flowers can be fertilized by pollen from the same tree. Hence varieties in this group can be planted singly, or large acreages can be planted to a single variety with very good results. In addition to the Alley and Pabst, other well-known early bloomers are Centennial, Georgia, Haven, Mobile, Moore, Nelson, Randal, Rome, San Saba, and Success.

Late Blooming Group.—This group comprises some of the best known commercial varieties. The bud scales are long and slender. The catkins, when they push out from the scales, are also long and slender, and contain numerous spur-like bracts shielding the small staminate flowers on the catkins. However, the important characteristic for the grower of this group is the fact that the catkins shed their pollen after a large per-

centage of their pistillate flowers are too old and dried up to receive the pollen and the flowers cannot be fertilized by pollen from the same tree or variety. *The varieties in this group, if planted singly, will yield only poor crops. They should never be set in commercial quantities unless interplanted with some of the early blooming varieties to serve as pollinators.*

The varieties comprising this group are the Bradley, Curtis, Delmas, Frotscher, Moneymaker, President, Russell, Schley, Stuart, Teche, Van Deman, and Waukenah.

Method of Interplanting the Two Groups.—

Where late blooming varieties are selected, the following outline suggests the arrangement of the two groups of varieties so as to aid pollination:

Group I.	0	0	0	0	0	0	0	0	0	0	0	0
Group II.	0	0	0	0	0	0	0	0	0	0	0	0
Group II.	0	0	0	0	0	0	0	0	0	0	0	0
Group II.	0	0	0	0	0	0	0	0	0	0	0	0
Group I.	0	0	0	0	0	0	0	0	0	0	0	0
Group II.	0	0	0	0	0	0	0	0	0	0	0	0
Group II.	0	0	0	0	0	0	0	0	0	0	0	0
Group II.	0	0	0	0	0	0	0	0	0	0	0	0
Group I.	0	0	0	0	0	0	0	0	0	0	0	0

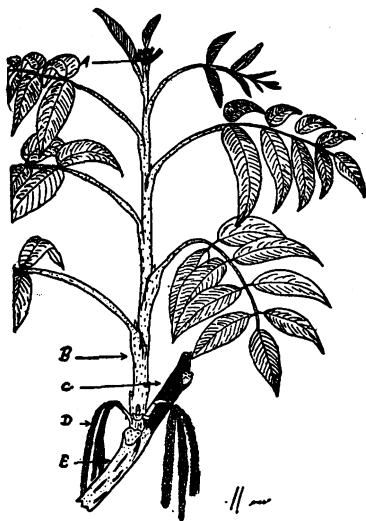
A greater number of rows is given to the late bloomers, for the best commercial varieties seem to belong to this group. In addition, these are more dependent upon the early bloomers for their pollen than the early bloomers are dependent upon them. While the early bloomers may be planted alone, better results are obtained on large acreages when some late blooming varieties are interplanted.

Varieties Adapted to Different Sections.—All of the varieties discussed previously are called Gulf Coast varieties, as they originated in the Gulf States. The

varieties in general use in this belt are Alley, Pabst, Schley, Stuart, and Success. The Bradley, Brooks, Moore, and Moneymaker varieties are in demand where the grower wishes prolific, early bearing and early ripening varieties to catch the early trade, even though the nuts are not quite so large or choice as those of the first five varieties named. Other varieties which are in demand in varying degrees in the different sections of the southern belt are the Curtis, Frotscher, Mobile, President, Russell, Teche, and Van Deman. However, there are varieties that originated in the northern states and also in the western states that are adapted to these sections. For convenience in selecting adaptable varieties, the pecan region of the United States has been

divided into four belts, known as the northern, middle, southern or Gulf Coast, and western belts.

Few large commercial pecan orchards have as yet been developed in the middle and northern pecan belts. This is due in part to the fact that the varieties adapted to these regions cannot compete on the markets with the varieties that can be grown in the South. However, from the plantings made, the Major, Green River Kentucky, and Warwick are recommended for the middle belt; and Posey, But-



FLOWERS OF THE PECAN

(a) Pistils; (b) new shoot; (c) old shoot dead; (d) staminate flowers; and (e) old growing shoot.

terick, Indiana, Busseron, and Niblack for the northern belt. Varieties which originated in the western belt will, as a rule, succumb to pecan scab when planted near the coast in the southern belt. However, they thrive well when planted in their native regions. The Burkett, Halbert, Oliver, Onliwon, San Saba, and Texas Prolific are generally grown in the western belt.

Description of Some Varieties.—The variety of pecan should be selected with the following points in view: (1) tree healthy, early bearing, early ripening, prolific, and resistant to diseases and insects; and (2) nuts large in size, well-filled, thin-shelled, and of good quality. It is not likely that one variety will be found to possess all of these characteristics; however, the variety which has most of them for any given locality should be planted.

The following are descriptions of some of the more important commercial varieties:



A CLUSTER OF FIVE PISTILS
READY FOR POLLINATION

GULF COAST VARIETIES

Alley: Originated in Jackson County, Mississippi, in 1896. Tree healthy, vigorous, prolific; nuts medium in size, shell thin; meat plump and of good quality; somewhat subject to scab near the coast.

Bradley: Originated in Baker County, Florida. Tree healthy, vigorous, very prolific; nuts small, shell medium in thickness,

rather hard; resistant to disease, well adapted to north Florida and southern part of Georgia.

Brooks: Originated in southwest Georgia. Tree very prolific, bears early; nuts medium in size, well filled, shell medium in thickness. This variety is very promising.

Frotscher: Originated in Iberia Parish, Louisiana. Tree vigorous, generally free of disease; prolific in regions where it is adapted; nuts large, shell very thin, cracks easily; meat only medium in quality.

Mobile: Originated in Mobile County, Alabama. Tree medium in vigor, bears early, very prolific; nuts oblong, medium to large in size, fill poorly; nuts fill less as the trees get older, a characteristic which has caused many to discard this variety.

Moneymaker: Originated in Madison Parish, Louisiana. Tree straggling grower, resistant to disease, bears early, very prolific; nuts medium in size, somewhat round, thick shell; meat plump, good flavor. The heavy bearing habit of the Moneymaker has made it a popular variety.

Moore: Originated in Jefferson County, Florida. Tree moderately vigorous, bears early, very prolific, ripens its nuts early in the season; nuts below medium in size, shell medium in thickness, well filled, fair quality. This is a popular variety in parts of north Florida and south Georgia.

Pabst: Originated in Jackson County, Mississippi. Tree very rank grower, comes into bearing late, sometimes scabs near the coast, moderately prolific; nuts medium to large, shell medium to thin, well filled, excellent quality. The Pabst is rated as one of the high-class standard varieties.

President: Originated in Duval County, Florida. Tree vigorous, prolific, well adapted to north Florida; nuts below medium in size, oblong in shape; shell medium in thickness, fills fairly well with meat of good quality.

Russell: Originated in Jackson County, Mississippi. Tree medium in vigor, prolific; nuts medium in size, very thin shell,

oblong, meat shrunken and only fair in quality. This variety once popular, is being rapidly replaced by others.

Schley: Originated in Jackson County, Mississippi. Tree moderately vigorous, sometimes scales near the coast, only moderately prolific; nuts medium in size, very thin shell, fills well; meat very rich in oil, excellent quality. The Schley is ranked by some as the highest quality nut grown.

Stuart: Originated in Jackson County, Mississippi. Tree a strong grower, vigorous, healthy; nuts large, shell medium in thickness, fills well; meat of good quality. The Stuart succeeds over a large area and is possibly more generally grown than any other one variety.

Success: Originated in Jackson County, Mississippi. Tree vigorous, moderately resistant to disease, prolific; nuts large, shell medium in thickness, fills well; meat of good quality. The Success resembles the Moneymaker except the nuts are larger.

Teche: Originated in Iberia Parish, Louisiana. Tree vigorous, healthy, very prolific; nuts medium in size; shell medium in thickness; meat only fair in quality. The heavy bearing of the Teche has caused many growers to plant it even though the nuts are not of the best quality.

Van Deman: Tree strong grower, sometimes scabs near the coast; nuts large, oblong, very attractive; fills well with meat of good quality. In many localities the Van Deman is a shy bearer. It has lost ground in recent years.

WESTERN VARIETIES

Burkett: Originated in Calahan County, Texas. Tree medium in vigor, prolific; nuts large, thin shelled, well filled. This variety is adapted to west and central north Texas.

Halbert: Originated in Coleman County, Texas. Tree vigorous, well adapted to the west Texas pecan belt, but scabs in the humid climates of the Southeast; nuts rather small, very thin shelled, fill well; meat of excellent quality.

Oliver: Originated in Kimble County, Texas. This variety has gained favor in Texas; nuts large, shell rather thick, fills well, good quality.

Oliwon, Texas Prolific, and San Saba: Three Texas varieties that fill well, have thin shells, and are of high quality. These, however, along with other west Texas varieties, should be confined to that territory as they suffer from scab when grown in the Southeast.

NORTHERN VARIETIES

Busseron: Originated in Knox County, Indiana. Tree hardy; nuts only medium in size. This variety is seldom planted in the South, but has a place in the northern part of the pecan belt.

Greenriver: Originated in Henderson County, Kentucky. Tree hardy, vigorous; nuts below medium in size, shell somewhat thick, fills well; kernel plump, good flavor. This is one of the most promising of the northern varieties.

Indiana: Originated in Knox County, Indiana. Tree hardy, vigorous; nuts medium in size, shell rather thin, fills well, cracks easily. The Indiana is ranked as one of the best of the northern varieties.

Major: Originated in Henderson County, Kentucky. Tree vigorous, hardy; nut below medium in size; shell thin, fills well, meat of good quality. This variety has not yet been grown over a very wide territory.

Niblack: Originated in Knox County, Indiana in 1913. Tree hardy; nut below medium, shell rather thick, fills well, cracks well. A good variety for home use in the northern part of the pecan belt.

Warrick: Originated in Warrick County, Indiana. Tree rather vigorous, prolific; nut rather small, shell moderately thin, fills well; meat of good quality.

Where to Buy the Trees.—Pecan trees are the most difficult of all the orchard fruits to propagate. Men who are experts with peaches and apples make almost complete failures with pecans unless they are particularly skillful. For this reason, unless a prospective grower has had experience in propagating pecans, he will save money and time by buying his trees from a reliable nurseryman. Other things being equal, get the trees as near home as possible. This will save a part of the transportation charges and may lessen the length of exposure of the tree to rough handling and unfavorable conditions. It is a risky business to buy from traveling tree agents unless the agent is known to be both responsible and competent. Do not buy trees merely because they are cheap. Examine the tree to see whether it is a seedling or a budded tree. Seedlings are useful for shade but have only one chance in a thousand of producing salable nuts. A mistake made here is not likely to be discovered until the trees begin bearing some five or six years later.

Grade of Trees to Buy.—When pecan trees are sold they range from three to four years old from the seed, that is, the roots are three or four years old, and from one to two years old from the budded or grafted portions. The sizes are from two to three feet, three to four feet, four to five feet, and five to seven feet. Sizes from three to five feet are most desirable for planting. Trees smaller than this are liable to be stunted and not grow off as well, while larger trees are more expensive to transplant and more difficult to make live.

Care of the Young Trees.—Pecan nursery trees will stand probably less abuse and less exposure than almost any of the fruit trees commonly handled. It is therefore exceedingly important that the roots be pro-

tected against rough handling and the drying effects of storage and weather conditions from the time they leave the nursery until they are set in place in the orchard. As soon as received from the nursery, the trees should be carefully "heeled in" in moist soil. The method of "heeling in" trees is explained under Peaches. When the trees are taken up and carried to the field for transplanting, they should be kept wrapped in wet sacks or have their roots submerged in a barrel of water.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. What two points should a prospective grower consider before selecting his trees?
2. What mistakes have growers made along this line?
3. What two types of flowers does the pecan tree bear?
4. What is the function of each type?
5. Name some other trees that have similar types.
6. Into what two groups can the varieties of pecans be divided?
7. How can each group be distinguished?
8. Name some of the common varieties in the early blooming group.
9. Name the common varieties in the late blooming group.
10. Why can the first group be planted singly? Why cannot the second group be planted singly?
11. What are the varieties of pecans planted in your neighborhood? To which group do they belong?
12. Are blocks planted to a single variety or are two or more varieties intermingled?
13. Draw a diagram of the suggested method of interplanting two varieties.
14. Why are more rows allotted to the late blooming varieties?
15. What points should be considered in selecting a variety?

16. Which variety adapted to your section more nearly measures up to these qualifications?
17. Where should the trees be purchased?
18. What are the grades of trees sold? Which are considered best for commercial planting?
19. What care should the young pecan trees receive from the time they are taken from the nursery until planted in the field?

SUGGESTED EXERCISES

1. Make a collection of varieties of pecan nuts and determine which fill well and which do not fill well. Learn to identify each of these varieties.
2. Visit pecan orchards during the spring and place the different varieties into the proper groups according to the type of catkins they produce.

CHAPTER XVIII

PECANS—PROPAGATION

Job 3—Propagating the Pecan

The pecan is more difficult to propagate than most other orchard crops. The student who becomes proficient in the budding or grafting of pecans has equipped himself for a remunerative vocation, as skilled workers along this line are in considerable demand. Pecans do not come true from seed. Consequently, the practice of planting seedling pecan orchards for commercial purposes has long since been abandoned. The pecan cannot be propagated from cuttings. Budding and grafting seedling pecan trees are the methods used.

In regions covered by native pecan forests, groves of improved varieties may be established by top working native trees with buds or cions from choice varieties. However, most commercial orchards are established from young trees grown from seeds and budded or grafted in the nursery.

Kind of Nuts to Plant.—Improved varieties of pecans may be planted for growing seedling trees to be budded or grafted. However, these are more expensive and no better for this purpose than plump, well-filled, medium-sized seedlings which may be bought from almost anyone having bearing seedling trees.

The nuts may be planted as soon as harvested or at any time from harvesting in October and November until about the fifteenth of the following February.

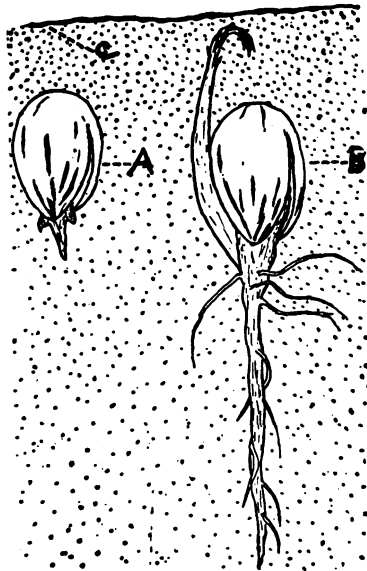
Soil for Pecan Nursery.—As it is very important that the seedling pecans should grow off rapidly, the soil for the pecan nursery should be carefully selected. It should be fertile, to give growth to the young trees, and should be a friable sandy loam, which will enable the sprouting nut to push the young seedling through the soil. Such soil facilitates cultivation and does not become unduly hard if the trees are dug in wet weather.

When a sandy loam soil has been selected, it should be made fertile with liberal applications of stable manure or commercial fertilizers.

Preparing the Land.

—About two weeks before planting the nuts, the land should be broken with a two-horse plow and harrowed. It should then be laid out in rows five feet apart. A fertilizer analyzing about 5 percent nitrogen, 8 percent phosphoric acid, and 3 percent potash is strewn in these furrows at the rate of from 500 to 700 pounds per acre. A broad, flat-topped ridge is then thrown on the fertilizer by means of a small turn plow.

When ready to plant, the grower opens this ridge with



PECAN NUTS GERMINATING IN THE SOIL

(a) The bursting of the shell; (b) the seedling becoming established in the soil; and (c) the soil line.

a four-inch shovel or bull-tongue plow, and drops the nuts from five to eight inches apart in the furrow. They are then covered to the depth of about two inches. A double-footed plow, or whatever is used for covering corn, will serve for this purpose.

Cultivating and Fertilizing the Young Trees.—

When the young trees come up the following spring, they are cultivated with any convenient cultivator, just as cotton is cultivated. This is to keep them free from grass and weeds.

If the plants show a lack of vigor, a side application of a nitrogenous fertilizer, such as nitrate of soda or sulphate of ammonia, should be made during the month of June.

The second spring after the nuts are planted, the nursery trees should be fertilized with the same application as that given before the nuts were planted. This should be repeated each spring thereafter as long as the trees stay in the nursery. The fertilizer may be strewn along between the rows of young trees just before growth begins in the spring, and worked into the soil with any convenient cultivator.

Budding and Grafting the Seedlings.—During the second summer a large number of the seedlings will be large enough to bud. They should be about one-third inch in diameter. The less vigorous ones should be budded the following summer. Seedling pecans send down roots about two and one-half feet the first season, but make only about ten or twelve inches of top growth.

Where grafting is to be practiced, it may be done during the winter following the second summer's growth of the seedlings.

It is important to have all materials ready beforehand for budding or grafting pecans. Grafting wax,

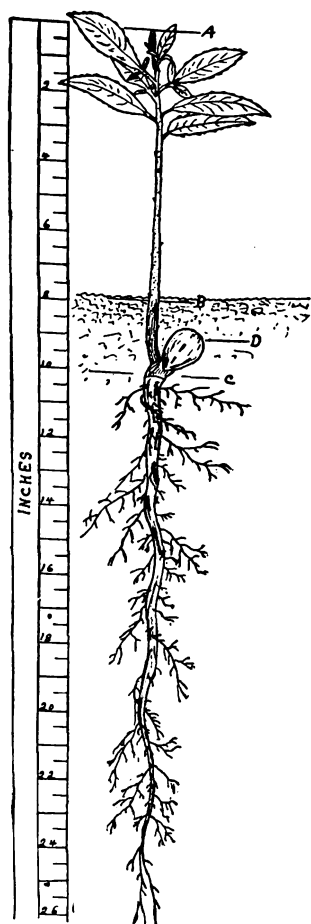
grafting knives, and cotton string should be in readiness for the work.

Grafting Wax.—The following is a recipe for making grafting wax. Melt together two parts of rosin and one part of beeswax. Just before this melted mixture becomes hard, pour in wood alcohol or grain alcohol until the mixture becomes quite soft and yellow in color. It may then be inclosed in a tight receptacle and set aside until ready for use.

Another mixture in common use is rosin, four parts by weight; beeswax, two parts by weight; and tallow, one part by weight. The mixture is melted together and poured into cold water. As soon as it is cool enough to be handled, it is worked and pulled until it becomes an amber or light straw color, when it is ready for use.

Budding the Pecan.—There are certain terms that the beginners in budding and grafting should know. The following are the most common:

Stock: The seedling used in budding or grafting.

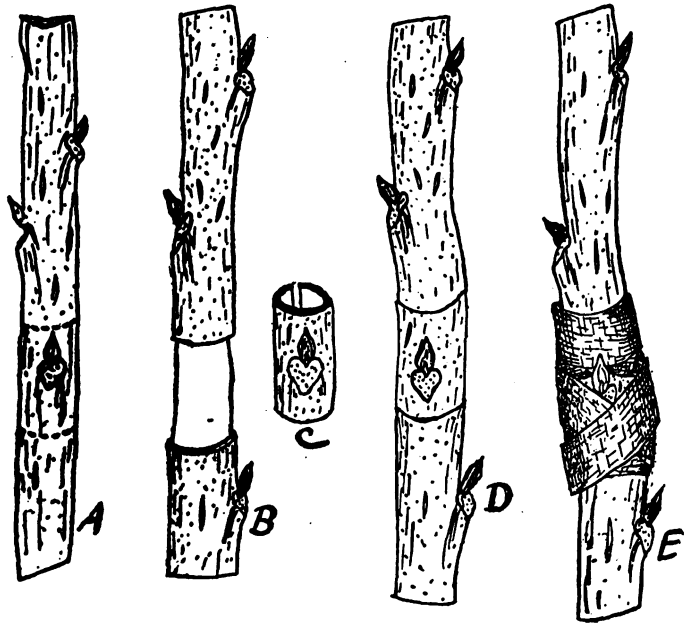


ROOT SYSTEM OF YOUNG
PECAN SEEDLING

Planted January 1; came up
in April; and drawing made
June 2.

The stock supplies the root system of the budded or grafted tree.

Cion: The leaf bud used in budding and the twig used in grafting are both broadly named cion even



THE RING-BUD METHOD OF BUDDING

(a) Bud before cutting; (b) the stock ready for the bud; (c) the bud; (d) the bud in place; and (e) wrapped.

though the bud is more specifically known as the bud and the twig as the cion.

Cambium Layer: The active growing part of a tree. It is the layer of cells just beneath the bark and on the surface of the wood of a twig just starting growth in the spring. Easy separation of the cells of the cambium layer enables the boy to slip the bark on a twig of hickory in making a hickory whistle.

In all budding and grafting it is absolutely essential that the cambium of the stock come in contact with the cambium of the bud or cion. If this is not done the bud or cion will die.

Kind of Buds to Use.—There are three kinds of buds that can be used for budding pecans: (1) buds of the new growth which mature sufficiently to be used in July; (2) dormant buds on twigs of past season's growth which are cut just before growth begins in the spring and held in cold storage or buried in a cool place until the bark on the stocks will slip in the spring. At this time the bud stocks are brought out into a warm place for about 36 hours, when the buds may be cut off and used; and (3) reserve buds which are the buds on the limbs of one, two, and three years' growth behind the new growth, which have remained dormant or inactive. These buds may be cut and used as needed at any time during the budding season. In cutting such buds, however, the new growth on the ends of the limbs is destroyed.

The Patch Bud.—The two methods of budding most commonly employed in propagating pecans is the patch bud and the annular or ring bud.

By using reserve and dormant buds, patch budding may be begun in the early spring as early as the bark of the stocks will slip, and continued until August or as late as the bark continues to slip in the summer.

On nursery stock the patch bud is set from two to four inches above the ground. On trees from one to two inches in diameter, it should be set from six to eight inches from the ground.

The patch bud is made by drawing the budding knife across the stock leaving two parallel incisions a little less than one inch apart. A sharp pocketknife is then used to make two vertical cuts on either side about one-

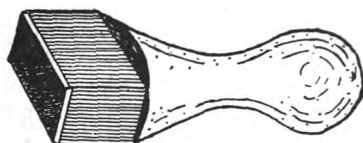
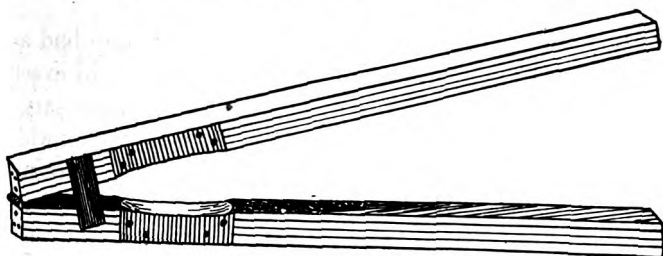
half inch apart. Cut through the corners so as to prevent hanging when the bark is lifted out. The bark on the stock should be lifted carefully until entirely free, then pressed back in place while the bud is being prepared.

Prepare the bud in exactly the same way. Then the bark should be removed quickly from the stock and the bud inserted promptly. It is very important to make the transfer rapidly so as to prevent the drying out of the exposed cellular tissues. The bud should fit snugly into its new location, held firmly in place with the thumb, and then tied with a cotton string. From five to eight wraps should be made to each bud, and the string drawn tightly enough to hold it firmly against the stock. It is important to have the string cut and ready to use so as not to cause any delay. As soon as the bud is tied into place, the whole patch, the bud, and all the cut places should be coated with melted grafting wax or melted paraffin. In applying the melted wax or paraffin care should be taken to have it just warm enough to melt, as hot wax or paraffin will injure the bud.

Care of the Young Tree After Budding.—The strings should be cut on all living buds from two to three weeks after insertion, depending upon the condition of the stock. It is easy to tell when a bud is living by pricking the bark supporting it with the point of a knife. If it is plump and green the string should be cut on the opposite side from the bud.

Forcing the Young Bud.—After the string is cut the bud should be forced. In young nursery stock this is done by cutting off the top of the seedling to within eight to twelve inches of the bud. In addition, it is often necessary to remove all native buds both below and above the point of insertion. It is not advisable to

force buds set after July first, as after the middle of July buds force very slowly and seldom make much growth before the dormant season. Such buds should be allowed to remain dormant until the following spring.



BUDDING TOOLS

The upper for ring budding.

Staking the Young Tree.—When the bud starts growth, the young shoot generally makes very rapid growth and soon becomes brittle and top heavy. To prevent its being broken it should be staked, when about four inches long, to the stock above. Heavy twine should be used and care taken not to girdle the young rapidly growing shoot. When the young shoot is about two feet long, the stub above it should be cut and a wooden stake driven into the ground to which the shoot should be tied for support.

Ring or Annular Bud.—Ring or annular budding is done in midsummer after July first. At that time the

bark will slip, and the buds are mature enough to grow. By this method the branches, three-quarters of an inch or less in diameter, may be worked. It is preferable that the stock and cion be of the same size. From the stock, remove a ring of bark from one inch to one and a half inches long. On the bud stick select a plump bud and remove the bud by taking out a ring which will exactly fit that made on the stock. To do this it is necessary to make a slit on the side of the ring opposite that on which is the bud. The ring of bark should then be carefully removed and placed upon the stock. Following this the bud should be securely tied in place with a cotton string and the entire surface waxed as described in patch budding.

Grafting.—Grafting can be done during December, January, and February when work is not pressing. The trees, the buds of which failed to “take” during the summer, can be grafted during the winter. The cion is forced out with the beginning of growth in the spring, thereby allowing the full season for the development of the young top. In addition, the graft is below the ground which gives a cleaner and smoother top than is secured by budding.

Whip-Grafting.—Whip-grafting is practiced only on young nursery trees. The stock should be from one to three years old, and from one-fourth to one inch in diameter. The cions may be taken fresh from the tree. They should be of the last year’s growth, of straight, clean wood, and thoroughly dormant.

The soil should be pulled back with a hoe from the seedlings so as to expose from two to three inches of the crown of the trees. A cloth is drawn around the stock in order to remove all dirt and trash. Then at a point from one to three inches below the surface, de-

pending on the smoothness of the stock, the top should be removed with a slanting upward cut, making the surface of the cut about three times as long as the diameter of the stock. Next, the knife blade should be placed about one-third of the distance from the top point and the slit made downward and inward about one and one-half inches in length. The cions should be about the size of a lead pencil, from four to six inches long, and should contain from two to four buds. The cion is cut like the stock, the slit being made at the butt end. The two should be fitted together and wrapped from four to five times with unwaxed cloth or string. As soon as the graft is completed, the soil should be piled around the cion so that not over one inch at the top will be exposed.

When growth starts in the spring, all shoots below the cions should be removed. In case the cion fails to live, one strong shoot from the stock should be allowed to grow. It will often become large enough by the first of July to allow patch budding. The cions that live should receive thorough cultivation so that they will be ready for transplanting by fall.

Bark-Grafting.—The best time to insert the bark-graft is when the trees have forced into growth sufficiently for the bark to slip freely. Bark-grafting is employed principally in working over large trees. The limbs used as stock vary in size from one to four inches in diameter. The cions should be from one-fourth to one-half inch in diameter, and from four to six inches long. They should contain from two to four buds and should be taken when dormant and kept in such condition until used.

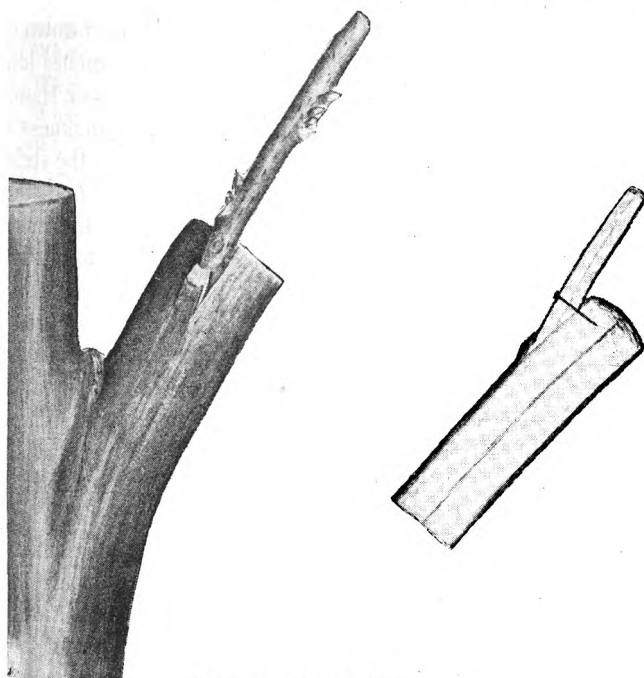
Well-placed limbs of the desired size and position should be sawed off from 10 to 18 inches from the body of the tree or from the junction of a large limb. The cut

surface is then smoothed off with a sharp knife. The bark on one side of the stub is split downward from one to two inches and lifted at the corners. If the bark is very thick and coarse it can be pared down. The cion is cut flat on one side at a distance of about one and one-half to two inches, and forced into the slit. It is better to cut the cion so that the lowest bud will stand on the outside just above the stock. The stock with the inserted cion is wrapped securely three or four times with stout twine. A small peg, a little larger than a toothpick, is pushed under the twine on both sides of the cion. All cut surfaces are carefully waxed. The work should be examined every few days for cracks. These should be carefully rewaxed. A small paper sack slipped over the cion and bound to the stock will often prevent the cion from drying out before it has had time to unite with the stock. The sack should be removed as soon as the cion starts into growth.

Advantages of Top Working Pecan Trees.—Large pecan trees are top worked, i. e., the limbs budded to improved varieties, for the following reasons: (1) seedling trees which do not bear or which produce a poor grade of nuts can be converted into improved varieties by this method; (2) unsatisfactory varieties, those which may be susceptible to disease or which may not be adapted to the region, can be changed to more suitable varieties; and (3) new and untried varieties can be hastened into bearing for trial purposes by budding or grafting a fairly large tree with the cions from the new variety. These will often produce some nuts the second year after being budded or grafted.

Top Working Pecan Trees.—When top working pecan trees to improved varieties was first begun, it was the practice of some propagators to cut the limbs of the

tree back to stubs during late winter and then graft them with cions from improved varieties by the cleft graft method. In recent years budding has come into more common use in top working pecans. The patch bud method is used more and is practiced by two radically



GRAFTING LARGE TREES

The scion is nailed in and then paraffined.

different methods. First, most of the limbs are removed from the pecan tree during the winter and the new sprouts which put out from the stubs of the removed limbs are budded the following summer by the patch bud method just as described for budding small nursery seedling trees. Second, the rough bark patch budding

of limbs during the growing season without removing them for young sprouts to grow out is used.

Rough Bark Patch Budding.—From four to six limbs, not exceeding two inches in diameter are selected so as to distribute the buds properly for forming the new head of the tree. The rough bark is pared down on spots on these limbs about two and one-half inches long and one inch wide. This rough bark on the stock should be trimmed down until it is about the same thickness as the bark containing the bud. This will allow the string used in tying to press tightly on the inserted bud, thus insuring the cambium layers of both bud and stock meeting at all points. Care should be taken not to cut into the live tissue. A patch of bark is here cut out and a patch of bark containing a bud from some improved variety inserted and tied in place just as in the other method of patch budding. At the end of three weeks, the bud will have united with the limb if it is going to live, at which time the ligaments or bandage material should be removed. The limbs are then cut off about one foot beyond the inserted buds. It is well also to remove limbs from the body of the tree for a distance of two or three feet above the buds. The buds are then forced into growth and allowed to grow with little further attention during the remainder of the summer unless it becomes necessary to support the young shoots to prevent their being blown off by the wind. Early the following spring the stubs of the limbs are cut back close to these new shoots and all or nearly all of the other limbs of the tree removed so as to give the sprouts from the inserted buds a chance to form the new head of the tree. As these become large enough to carry on the functions of the tree, all the native limbs are removed. Paint or wax cut ends of large limbs to prevent decay.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. How are pecans propagated?
2. What kind of nuts should be planted to produce the seedlings?
3. When should these nuts be planted?
4. Why is the proper soil so important for a pecan nursery?
5. What kind of soil should be selected?
6. When and how should the land be prepared?
7. How are the nuts planted?
8. What cultivation and fertilizers should be given the young trees?
9. When are the young seedlings ready for budding? For grafting?
10. What material should be ready beforehand?
11. How do you make grafting wax?
12. Bring a seedling to class and show the cambium layer, the stock, the bud, and the cion.
13. In all budding and grafting what is the essential point?
14. What kinds of buds are used and for what is each used?
15. Where can you obtain buds suitable for budding?
16. By using a seedling give an illustration before the class of patch budding.
17. What care should be taken of the young trees after budding?
18. How should the young bud be forced?
19. Why should buds not be forced after the middle of July?
20. How should the young tree be staked? Why?
21. Give an illustration before the glass of annular budding.
22. What are the advantages of grafting?
23. For what is whip-grafting used?
24. How old and of what size should the stock be?
25. What kind of cions are used?
26. Give a demonstration to the class of whip-grafting.
27. What after-care should be given the whip-graft?
28. For what is bark-grafting used principally?

29. At what season can bark-grafting be done?
30. What size should the limbs be?
31. What size should the cion be?
32. What kind of bud should the cion have?
33. Draw a diagram on the board showing what limbs of a tree should be selected for bark-grafting to make a well-balanced head.
34. Give a demonstration in class of the method of bark-grafting.
35. How can the cion often be prevented from drying out?
36. Why are large trees often top worked?
37. What two methods of budding are in common use for top working trees?
38. How does rough patch budding differ from patch budding?
39. What after-care is given the buds on a top worked tree?

SUGGESTED EXERCISES

1. Visit the nearest pecan nursery and study the methods employed in propagating, growing, and selling nursery trees.
2. Secure a budded pecan tree and a seedling tree which has been cut off and a new top formed from a sprout coming out from the side. Split each of these trees open and show how the pith is continuous in the seedling while there is a layer of wood between the stock and cion of the budded tree. This is one means of telling the difference between seedling and budded trees.
3. As a class exercise practice budding and grafting as explained in the text until skill is acquired in the operation, then bud pecan trees if possible, but if not available at the time bud other kinds of trees.
4. As a class exercise top work an old tree in order to become familiar with the principles involved in the operation, and if possible, practice until skill is acquired.

CHAPTER XIX

PECANS—PLANTING AND CULTIVATING

Job 4—Preparing the Land for Pecans

Where feasible, a summer cover crop of legumes should be grown and turned under in preparation of the land for pecans. Then 50 or 60 days before the trees are to be planted the soil should be thoroughly broken, broadcast, and harrowed. If an inch or two of the sub-soil is turned up at this time some benefit will be gained. A good dressing of barnyard or stable manure broadcast and turned under at the same time will give good results. Just before the trees are to be planted, a harrow should be run over the land to freshen the surface of the soil.

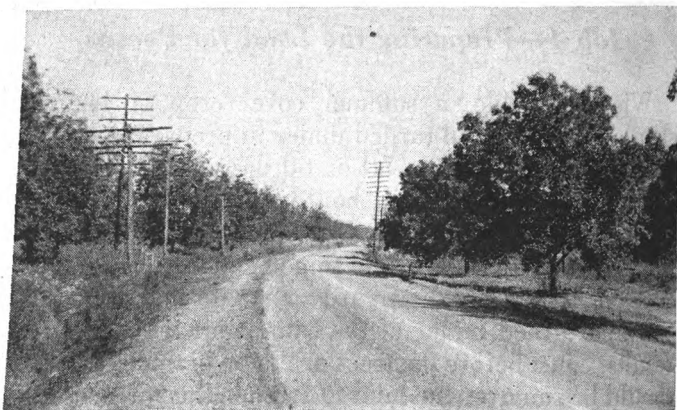
Laying Out the Orchard.—The rows may be laid out for a pecan orchard by exactly the same methods, the square and following the contour of the land, as described for laying out a peach orchard, except that greater distances are allowed between the trees.

The mistake is often made of spacing the trees too closely. Trees should be spaced at least 46 feet and 8 inches apart on uplands, and from 60 to 72 feet apart on fertile bottomlands. The number of trees set at different distances on a given area is as follows:

Number of Trees to Ten-Acre Square

46 feet, 8 inches	200 trees
60 feet	121 trees
72 feet	84 trees

Time to Plant.—The proper time to plant pecan trees is from the first of December until the middle of February. They can be planted two weeks before and two weeks after this period, with fairly good results. Trees planted during the early part of the winter have



Courtesy of G. C. Starcher

PECAN TREES ARE WELL SUITED FOR ROADSIDE PLANTING

an advantage over those planted late, as the roots have time to callous over the cut ends and growth begins earlier in the spring.

Digging the Holes.—If the land is deeply plowed, the digging of very large and deep holes is unnecessary. The hole may be dug 18 or 20 inches wide and deep enough to accommodate the lateral roots of the young tree. In the center of the bottom of this hole may be made a small hole deeper down with a post auger in which to place the tap root of the young tree. In any event it is not best to cut back the tap root in order to make it fit the hole. It is better to make the hole deep enough for the tap root. The same relation between the

size of the hole and the size of the root system of a young pecan tree should exist as in setting out any other fruit or forest tree. Make the hole large enough to comfortably receive the root system of the tree to be planted in it.

Use of Dynamite for Digging Holes.—Dynamite may be used in digging holes for pecan trees where the subsoil is reasonably dry or porous and will shatter with the discharge. Serious damage may be done with dynamite where the subsoil is wet and stiff. In such subsoils the discharge will form a hole with jug-like walls that will hold water and prevent seepage, causing the tree to drown out as well as preventing the roots from penetrating the side walls of the hole.

Job 5—Setting the Trees

Only the injured and broken roots of the young trees should be cut off as they are planted. Two men working together can best do the planting. Only top fertile soil, free of trash and coarse organic matter, is used in filling the hole around the roots of the young tree. The tree is set about two inches deeper than it stood in the nursery, and the soil is left loose and friable on top so as to prevent baking and the escape of moisture. It is safer not to put fertilizer into the hole at the time of planting. It is better to wait until spring, about the time growth begins, and spread the fertilizer on the surface around the tree and work it into the soil. In this way it will gradually penetrate the soil and feed the rootlets of the tree as they develop.

Pruning.—As soon as the tree is set it should be cut back to from 20 to 30 inches above the ground. As growth begins, from three to five sprouts of the new

growth should be left properly spaced to form a desirably shaped tree, and the others rubbed off. Low-headed trees are more convenient to spray, and harvesting the crop of nuts is much easier. They also suffer less from strong winds than trees headed high. After the pecan trees have been given the proper form the only pruning necessary is to take out an occasional leader to prevent the tree from reaching an excessive height, and to remove broken or injured limbs or limbs which interfere with one another.

Job 6—Cultivating the Orchard

In the spring following the setting of a young orchard some decision must be made in regard to the cultivation practices to be followed.

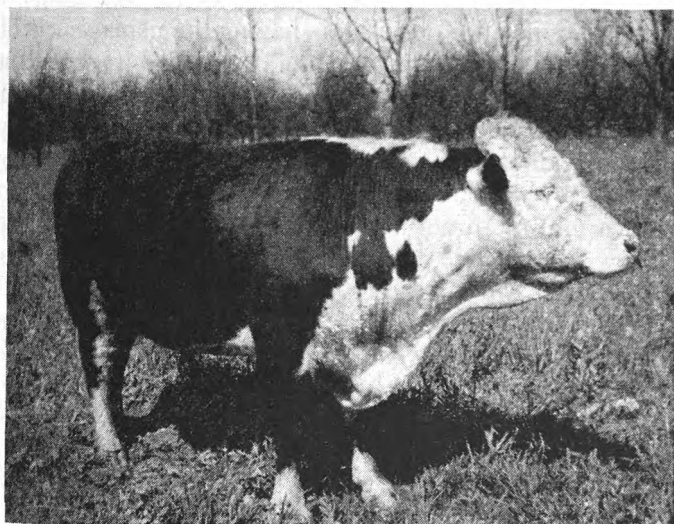
There are two general methods of cultivating a pecan orchard: (1) giving the entire orchard clean cultivation, and (2) growing crops between the rows of trees.

The young trees need only a small part of the space given them for the first few years after being planted. For this reason very few orchardists follow the practice of keeping the entire orchard cleanly cultivated until the trees reach the bearing age some eight or ten years after planting.

The practice to be recommended is to grow some low-growing farm or truck crop between the tree rows and give these crops good culture and fertilize them well until the trees become large enough to occupy most of the land.

Leave a Vacant Space Between Tree Rows and Growing Crops.—A space from 8 to 12 feet wide, depending upon size of trees, should be left along the tree rows to be kept cleanly cultivated during the spring and summer. In cultivating this space it is a good practice

to slip the plow trace chains into discarded bicycle tires or some other casing to prevent the traces rubbing the bark off the trees. A most careful plowman should be selected for cultivating these spaces.



Courtesy of G. C. Starcher

A PECAN ORCHARD BEING PASTURED

What Crops to Grow Between Rows of Pecan Trees.—Low-growing crops, such as soybeans, bush velvet beans, cotton, and most vegetable crops are suitable for growing between the rows of pecan trees. Just which of these the grower should select will depend upon which best fits in with his system of farming. Corn and sorghum should be avoided as they are likely to shade the trees in addition to consuming large supplies of soil moisture.

In growing crops between rows of pecan trees, if the soil is well prepared and the crop well fertilized and

cultivated, the land will remain in good condition for developing a pecan orchard. The pecan trees should not be made dependent upon the fertilizers applied to the intercultural crops, but should be fertilized separately.

Cultural Practices in Large Pecan Orchards.—Corporations and individuals having the management of very large pecan orchards often do not find it convenient to grow cleanly cultivated crops between the rows of trees or give the entire orchard clean cultivation. They naturally look for some method of taking care of the orchard by which improved farm machinery can be used with a minimum outlay for labor. Consequently, some follow the practice of breaking the land and sowing oats between the rows of trees in October, leaving the usual space along the tree rows to receive clean cultivation the following spring and summer. When the oats are well headed and partially matured the following spring, they are cut for hay and the soil immediately disked by means of a tractor and disk harrow in preparation for sowing the land to soybeans or bunch velvet beans. The crop of beans is either turned under in the early fall as a soil improvement crop or cut for hay. In the event this crop is cut for hay, the deficiency in plant food in the soil caused by removing two crops in one year must be made up by increased quantities of fertilizers.

Cultivating the Bearing Pecan Orchard.—After pecan trees reach an age of eight to ten years they should begin to produce profitable crops of nuts. Beginning at this point, liberal quantities of plant food and moisture are necessary for the production of satisfactory crops of nuts, for the reason that pecan trees must carry their crops of nuts through the hot summer and ripen them in the fall when there is usually a protracted drought. The soil of the bearing pecan orchard should be broken to

the depth of from four to five inches each spring. The land should be broken to about the same depth each year, as deep plowing following shallow plowing will greatly disturb the surface roots of the trees.

Implements to Use.—The ordinary double disk or orchard disk harrow drawn by a tractor or by mules may be used for cultivating the orchard during the spring. Following this the entire orchard should be kept cleanly cultivated until about the first of September. The spike-tooth harrow or almost any of the orchard disk harrows will serve for this purpose. If the cultivating is done as soon as feasible after each rain, the young weeds and grass are much easier killed.

Winter Cover Crops.—When cultivation is stopped about the first of September, seeds of rye and vetch or clover and vetch, crimson clover, or some other cover crop adapted to the region, should be sown broadcast over the orchard. This cover crop should be turned under the following spring and clean culture begun as before.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. What preparation of the soil should be made in the summer before planting pecans?
2. What fertilizer should be put on the land before breaking?
3. How long before the trees are to be planted should the soil be broken?
4. How are the rows for a pecan orchard laid out?
5. What distance apart should the trees be planted?
6. If put 60 feet apart, how many trees will be necessary for an acre?
7. How far apart are the pecan trees in your neighborhood planted?

8. At what time of the year should the trees be planted?
9. How large should the hole be dug?
10. What are the advantages and disadvantages of using dynamite for making holes?
11. Describe the process of planting a tree.
12. What pruning should be done when the tree is planted?
What other pruning will be necessary during the life of the tree?
13. What two methods of cultivation are in practice in pecan orchards?
14. Where intercultural crops are used what distance should be left between the crop and the tree for clean cultivation?
15. How should this space be cultivated?
16. What crops should be grown between pecan rows?
17. What are the cultural practices in large pecan orchards?
18. How should the bearing pecan orchard be cultivated?
How often?
19. What implements would you use for cultivating?
20. What are the cultivation practices in the orchards with which you are familiar?

SUGGESTED EXERCISES

1. Turn to the chapter on laying out a peach orchard and use the same method in practicing laying out a pecan orchard, using the distances recommended for pecans.
2. Visit some of the large pecan trees of your community and measure on the ground the distance of the spread of the limbs. Compare this with the distance apart that young pecan trees are usually planted and note whether or not the young trees will be crowded when they reach the size of the tree you measured.
3. Secure a few pecan nursery trees and set them out according to directions given in your text.
4. Visit nearby pecan orchards and study the methods and implements used for cultivation, and the kinds of crops grown between the trees from the time the trees were planted until they were in bearing.

CHAPTER XX

PECANS—FERTILIZING THE ORCHARD

Job 7—Fertilizing Pecans

A definite soil building policy should precede the setting of a pecan orchard. Unless the land is already fertile, it should be planted to soil building crops and well fertilized for one or two years before the trees are set. This does not apply so much to the rich alluvial soils of the river bottoms as it does to the thin upland sandy soils. After the trees are set out, plant food in the form of barnyard manures, commercial fertilizers, or cover crops should be put into the soil every year.

Barnyard Manure for Pecans.—Barnyard and stable manures are very beneficial to thin soils low in humus or organic matter for the following reasons: (1) they add plant food to the soil; (2) increase its water-holding capacity and to some extent reduce pecan rosette; (3) improve its texture and mechanical condition; and (4) increase the beneficial bacterial flora which assist in bringing the fertilizing mineral elements of the soil into a more available or soluble form for the use of the trees.

One pound of nitrate of soda contains about the same amount of nitrogen as 30 pounds of ordinary stable manure. However, when they are both applied to the soil, the stable manure would probably produce more tree growth for its beneficial effects to plant life extend beyond its plant food content.

Time to Apply Barnyard Manure.—From one-quarter to one-half of a ton of stable manure to a tree, depending upon its size, applied in late winter or early spring is a satisfactory quantity. It should be spread out in a circle around the tree extending out about twice the spread of the limbs and worked into the soil with any convenient plow or implement. The stable manure may be supplemented with from 10 to 20 pounds of acid phosphate to a tree and applied with the stable manure. However, in most regions where pecans are grown commercially, stable manure is produced in such limited quantities that the growers have to look to cover crops and other organic matter to keep up the humus content of the soils.

Cover Crops for Pecans.—For a long time it was thought that plowing under green cover crops would sour the land. Numerous experiments, however, have proved this a fallacy. Consequently, the growing and turning under of cover crops for the improvement of soils in pecan orchards has become an important practice. The influences of cover crops, when turned under the soil, are very similar to those of stable manure. A cover crop contains only the amount of phosphoric acid and potash which it withdrew from the soil, and at most it returns only that which was borrowed. However, a cover crop adds nitrogen which it obtains directly from the air in the soil.

Phosphoric acid and potash normally found in soils are almost insoluble in water. But they are both changed very greatly in solubility when found in the remains of cover crops. The potash from the remains of cover crops is soluble in water, while the phosphoric acid is combined with lime and other bases and is sufficiently soluble to be acted upon by the roots of plants. There-

fore, while the cover crop, with the exception of nitrogen, merely returns to the soil something which it has taken, it returns these elements in a more readily available condition for the use of the plants.

Value of Deep-Rooted Cover Crops.—Cover crops, especially the deep-rooted kinds, such as alfalfa, beggarweed, and sweet clover, perform another service in that they bring some of their plant food from the subsoil and deposit it as plant remains in the surface soil. This may seem somewhat unnecessary for such deep-rooted trees as the pecan. However, a careful study of the pecan root system will show that a very large majority of its feeding roots are found near the surface, while the deep roots are largely anchor roots for holding the tree in position. Exceptions to this are when the subsoil is very fertile and porous, affording favorable conditions deep down for root development.

Nitrogen Gathering Bacteria on Roots of Legumes.—While phosphoric acid and potash are fixed quantities in the soil, unless they are added from outside sources as commercial fertilizers, the amount of nitrogen varies with the ability of the cover crop to extract it from the air in the soil. This gain in nitrogen is brought about by bacteria which form nodules and live on the roots of leguminous plants, such as clovers, vetches, alfalfa, beggarweed, velvet beans, soybeans, cowpeas, etc. As is the case with stable manure, the value of a cover crop exceeds the actual plant food it contains on account of its beneficial effects on the mechanical condition and bacterial content of the soil. Furthermore, its chief constituent—nitrogen—which is taken from the air, has about double the commercial value of potash and four times the value of phosphoric acid.

Composition and Value of Cover Crops.—Where it is desirable to calculate the value of a cover crop to a soil, it is valued on a basis of its content of phosphoric acid, nitrogen, and potash. By getting the analysis or percentage of each of these elements a cover crop contains, it is an easy matter to calculate the total plant food content on a basis of cover crop yields. See table shown on page 235.

What Cover Crops to Use.—One essential is to select a cover crop which will grow well in the locality. Both leguminous and non-leguminous crops are used. Among the more suitable winter cover crops are alfalfa, bur clover, crimson clover, vetch, oats, rye, turnips, and rape; while some for the summer cover crops are beggarweed, Japan clover, bush velvet beans, and soybeans. Kudzu may be used on limited areas where the grower is careful not to allow the kudzu runners to cover the trees. Cowpeas have very largely been eliminated as a cover crop in bearing pecan orchards as they harbor a species of squash bug (Hemiptera), called the green stink bug, which attacks the young nuts during the summer and cause a defect called "kernel spot."

The combination, time of planting, and turning under or harvesting of a cover crop should be so arranged as not to interfere with the harvesting of the pecans. Where adaptable, those cover crops which reseed themselves should be selected to avoid the expense of buying seed each year. Where a stand of the southern bur clover can be secured in a pecan orchard it serves well for this purpose. Since it matures its seed in late April or early May, it can then be turned under and the land sown to a summer cover crop of soybeans, bush velvet beans, or beggarweed. Unless the land is poor the summer cover crop may be cut for hay in late August or early Septem-

**YIELD AND COMPOSITION OF ENTIRE CROP—TOPS
AND ROOTS
MONEY VALUATION OF GREEN MANURES
WEIGHTS AND PERCENTAGES RELATE TO AIR-DRY STATE**

Kind of Plant	Parts of Plant	Percent Nitrogen	Percent Phosphoric Acid	Percent Potash	Yield in lbs. per Acre	Lbs. Nitrogen per Acre	Lbs. Potash per Acre	Lbs. Phosphoric Acid	Relative Fertilizer Value
Soybean	Tops	1.92	0.68	0.56	6790	130.9	46.2	37.8	\$19.16
	Roots	1.22	0.24	0.31	756	9.3	1.8	2.4	1.28
	Total	1.86	0.64	0.53	7546	140.2	48.0	40.2	20.40
Cowpea	Tops	1.75	1.27	0.45	3718	65.2	47.4	16.6	10.69
	Roots	1.40	0.76	0.73	310	4.3	2.4	2.3	.71
	Total	1.73	1.24	0.47	4028	69.5	49.8	18.9	11.40
Vetch	Tops	3.53	2.56	0.74	3064	108.0	78.4	22.5	17.56
	Roots	2.19	1.18	0.79	600	13.2	7.1	4.7	2.08
	Total	3.31	2.34	0.74	3664	121.2	85.5	27.2	19.64
Rape	Tops	2.10	2.68	0.75	5533	116.2	148.2	41.8	22.60
	Roots	1.53	1.52	0.59	864	13.2	13.1	5.1	2.39
	Total	2.02	2.52	0.73	6397	129.4	161.3	46.9	24.99
Cow Horn Turnip	Tops	2.51	3.13	0.56	2565	64.4	80.3	14.3	12.18
	Roots	1.54	2.15	0.40	2902	44.7	62.4	11.6	8.83
	Total	2.00	2.61	0.47	5467	109.1	142.7	25.9	21.01
Crimson Clover	Tops	2.38	1.56	1.10	5372	128.2	84.0	59.2	21.36
	Roots	1.50	1.02	0.47	513	6.2	4.2	2.0	1.01
	Total	2.32	1.53	1.06	5785	134.4	88.2	61.2	22.37
Alfalfa	Tops	2.42	1.42	0.58	2267	54.8	32.2	13.1	8.58
	Roots	2.04	0.48	0.43	1980	40.4	9.5	8.5	5.59
	Total	2.24	0.98	0.51	4247	95.2	41.8	21.6	14.17
Red Clover	Tops	2.48	1.65	0.67	2819	69.8	46.5	18.9	11.28
	Roots	2.74	0.82	0.84	1212	33.2	9.9	10.1	4.78
	Total	2.56	1.40	0.72	4031	103.0	56.4	29.0	16.06
Velvet Bean	Tops	2.61	1.96	0.66	557	14.5	10.9	3.7	2.40
Rye	Tops	1.18	1.86	0.55	3096	24.7	39.0	11.4	5.25
Alfalfa	Tops	1.63	1.38	0.54	1126	18.4	15.6	6.0	3.17
Red Clover	Tops	1.85	0.99	0.35	2972	55.0	29.5	10.4	8.39
Red Clover	Tops	2.49	2.05	0.54	1371	34.1	28.1	7.4	5.72
Rye and Vetch	Tops	2.47	3.55	0.81	3687	91.1	130.8	29.9	18.37
Rye	Tops	0.83	1.54	0.45	2748	22.8	42.4	12.4	5.23
Rye and Vetch	Tops	2.74	1.56	0.70	5467	149.8	85.3	38.3	23.40
Crimson Clover	Tops	2.22	1.18	0.48	4640	103.0	54.8	22.3	15.77

ber. The bur clover seed which were turned under in May will germinate in the late summer or early fall and produce a good winter cover crop. Other similar combinations of cover crops may be made. Usually if one is turned under each year, the soil fertility will be maintained. But if the soil is very thin, it may be necessary to turn under both the winter and the summer cover crop.

Commercial Fertilizers for Pecans.—The common fertilizer elements usually found abundant in the soil as well as the chief functions of the three, nitrogen, phosphoric acid, and potash, found deficient in most soils were dealt with in Job No. 5 on fertilizing peaches.

Composition of Fertilizers to Use.—Fertilizer experiments conducted over a series of years show that a fertilizer mixture rather high in nitrogen is preferable on Greenville, Orangeburg, and Norfolk sandy loam soils which are most often used for pecan orchards. A high percentage of nitrogen in the fertilizer mixtures gives a relatively high percentage of protein in the pecan nut, while a high percentage of potash in the fertilizer mixtures gives an increase in the oil or fat content of the pecan.

For the soil types just mentioned, pecan trees up to seven or eight years after being planted should receive from 5 to 15 pounds to a tree each year of a fertilizer analyzing about 5 percent nitrogen, 9 percent phosphoric acid, and 3 percent potash. Pecan trees from 9 to 10 years old should receive 20 pounds, and trees from 11 to 12 years old should receive 25 pounds, increasing from 2 to 3 pounds each year according to condition and growth of the trees. After the trees are 9 or 10 years old the nitrogen in the fertilizer mixture may be reduced. A fertilizer containing 4 percent nitrogen, 9 per-

cent phosphoric acid, and 4 percent potash will be satisfactory for this purpose.

When to Apply Commercial Fertilizer.—The proper time to apply the fertilizer is just before the pecan trees begin growth in the spring. It should be spread uniformly around the tree and out almost twice the distance of the spread of the limbs.

Fertilizer Material to Use.—Price, composition, and availability of the plant food in fertilizer materials are factors to be considered in making up a fertilizer mixture for pecans as well as for other crops. Some of the materials in common use are acid phosphate as a source of phosphorus and muriate of potash, sulphate of potash, or kainit as sources of potash. The nitrogen or ammonia may be derived from two chief sources: those quickly available as nitrate of soda and sulphate of ammonia, and those more slowly available as cottonseed meal, dried blood, tankage, and fish scrap.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. How should land be handled for one or two years before setting a pecan orchard?
2. In what four ways does barnyard manure benefit the soil?
3. How does stable manure compare in nitrogen with nitrate of soda?
4. How much stable manure should be applied to pecan trees?
5. How much acid phosphate should be applied with stable manure?
6. What is now known in regard to cover crops souring land?
7. What effect has cover crops on the solubility of phosphorus and potassium in the soil?

8. What element of plant food does leguminous crops actually add to the soil?
9. In what way do deep-rooted cover crops improve the soil?
10. By what process do leguminous cover crops add nitrogen to the soil?
11. Name some cover crops suitable for a pecan orchard.
12. What cover crops are grown in the pecan orchards in your community?
13. What three fertilizer elements are most commonly deficient in soils?
14. What kind of fertilizer and how much would you use on pecan trees up to eight years old?
15. What kind and how much would you use after that year?
16. When and how would you apply the fertilizer?
17. What are the chief sources of nitrogen, phosphoric acid, and potash?

SUGGESTED EXERCISES

1. Visit pecan orchards near the school and note the effects of soil fertility on the sizes of the trees and yields of the nuts. Inquire of the owner his method of fertilizing and compare it with that suggested in your text.
2. Pull up and weigh roots and tops separately of a small plat of clover or vetch near your school. Consult the table in your text for the analysis of this cover crop and calculate its value per acre as a fertilizer.
3. Collect samples of commercial fertilizers, study the sources and uses of each, and learn to identify them without the labels.

CHAPTER XXI

PECANS—CONTROLLING INSECTS AND DISEASES

Job 8—Controlling Insects and Diseases of Pecans

As the pecan is a comparatively new crop with a limited geographical range, fewer pests have been discovered than for other horticultural crops such as the apple and the peach. However, there are a number of insects and diseases that do serious damage to pecans and make control essential to profitable nut production.

Hickory Shuckworm.—The shuckworm is prevalent over the whole pecan belt, attacking the nuts from the time they set until full grown. Small nuts are tunneled to the center and caused to drop early, resulting in loss of a considerable part of the crop. The hardened shell prevents deep burrowing of the shuckworm and late season injury consists of hindering proper filling and of causing shucks to stick. The injurious stage is a small yellow worm of which there are several generations a year. The adult stage is a small bluish brown moth.

Serious damage from the shuckworm can be stopped by plowing under or picking up the infested nuts that drop in June and July, killing the worms therein and preventing infestation of the full grown nuts. A disk-tiller or wheatland plow is required for a thorough job, turning the nuts under three or four inches of soil. One turning should be made July 10 to 15 and another three

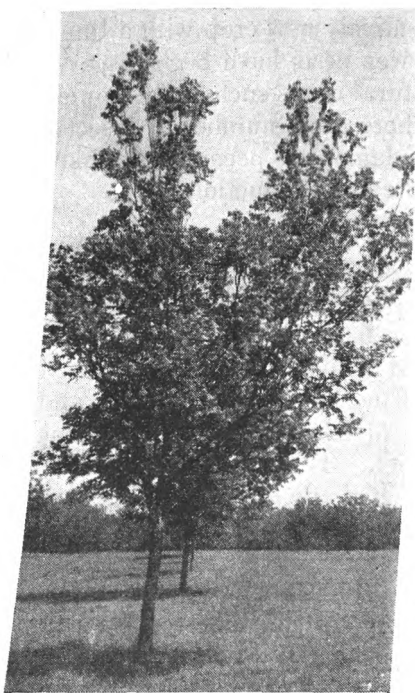
weeks later, starting at the same point in the orchard for both operations.

Gathering and destroying all pecan shucks in the fall, thus controlling the overwintering generation of shuckworms, although a good practice does not prevent summer infestation. No practical system of control by spraying has been discovered.

Pecan Nut Casebearer.—In Texas, northern Flor-

ida, and southern Georgia there is often trouble from another small caterpillar or worm, olive green in color, the nut casebearer. The overwintered generation of worms tunnel new pecan shoots while two later generations bore into the nuts at the base, beginning as soon as they set and building a little tube of silk and frass between the damaged nuts. A small gray moth with crest across each wing is the adult stage of this insect.

In the semi-arid parts of Texas the nut casebearer can be controlled with one application of lead arsenate, 6 pounds per 100 gallons applied



Courtesy of G. C. Starcher

**A PECAN TREE OVERCOMING
ROSETTE AFTER RECEIVING ZINC
SULPHATE AND OTHER PLANT FOOD**

just after the eggs on the nuts begin to hatch, or about the middle of May.

In humid regions such as eastern Texas and southern Georgia, lead arsenate is unsafe and a spray of nicotine sulphate combined with mineral oil emulsion or with bordeaux mixture is used. With either material it is necessary to examine the small nuts with a hand lens and determine first, whether or not there are enough case-bearer eggs to justify spraying and second, whether have they begun to hatch. The correct time to spray about coincides with the completion of pollination.

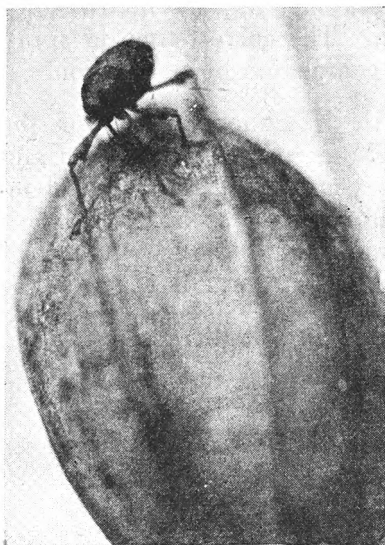
Pecan Weevil.—In the Piedmont region of the southeastern states, and also in parts of Louisiana and Texas, the pecan or hickory-nut weevil does great damage to most of the leading commercial varieties. This pest has never become established in the main center of production of southwestern Georgia. It seems to be most injurious in areas of hickory and native pecans. Nuts are punctured by the long-snouted weevils or beetles from July 15 to September 15 and eggs are laid during the last two weeks of this period. The earliest punctured nuts fall off; in the later, grubs hatch and are found as fat yellow worms at harvest time. These worms bore their way out, dig into the ground about six inches, and there spend two years before a new generation of weevils emerges to renew the attack.

The only known means of control for the pecan weevil is by bumping pecan trees and catching the weevils on large sheets to prevent them from laying eggs in the nuts. This work starts the latter part of July and continues about once a week until mid-September, or as long as weevils are abundant. In 10- or 15-year-old trees bumping can be done with padded poles from the ground, with larger trees workmen climb and shake the limbs. In

every pecan orchard certain trees, usually the largest, are heaviest infested year after year and on these the grower should concentrate, bumping other trees as necessary. Weevil infested nuts should be gathered as soon as possible and placed where the emerging grubs cannot burrow into soil.

Kernel Spot.—Occasionally ripe pecan kernels

show dark sunken spots of irregular size. These are caused by the sucking of stink bugs or pumpkin bugs, while the nuts are maturing. There is no evident mark on the outside. Nuts punctured by these bugs in midsummer before filling turn black and drop early.



A PECAN WEEVIL PUNCTURING NUT

The injurious bugs fly into pecan trees from cowpeas, tomatoes, and other crops and weeds such as Jimson weed, on which they breed. Clean cul-

tivation of pecans in summer largely prevents kernel spot.

Black Pecan Aphid.—Turning from the nut destroyers to the insects infesting the leaves of the pecan, one of the most injurious is the black aphid. The myriads of these tiny pests make yellow spots on the leaves and cause them to drop in summer before the nuts have

had a chance to fill. There are also two species of yellow aphids that suck the juice from pecan leaves and produce great quantities of honeydew, but they do not kill the leaves as does the black aphid.

To control this aphid, pecans are sprayed with nicotine sulphate, usually adding it to the scab spray. Spraying trees with bordeaux in some way causes an increase in aphids making it necessary to follow bordeaux with nicotine sulphate.

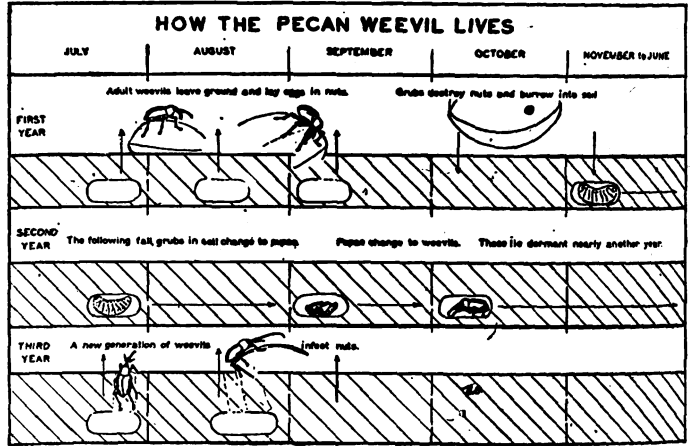
Pecan Leaf Casebearer.—The leaf casebearer is abundant in the Coastal Plain and may cause damage by feeding on nut and leaf buds in the spring. The insect, which is a dark green worm, one-half inch long, constructs a gray tube between the leaves in which to feed in the spring and in which to pupate. The adult stage is a gray and brown moth. From its eggs come worms that make tiny winding cases on the underside of leaves in late summer. One application of calcium arsenate in bordeaux mixture early in July will control the leaf casebearer, however, arsenicals are quite injurious in dry weather, and it seems better to eliminate this spray. In Texas lead arsenate spray, 4 pounds to 100 gallons, is recommended.

Fall Webworm and Walnut Caterpillar.—These two species of caterpillars work in colonies, the former with webs, the latter without, denuding branches of leaves. Both become moths in the adult stage. The webworms are particularly conspicuous some years, covering large parts of trees. These can be readily controlled by spraying with an arsenical if local conditions will allow it, or the colonies can be pulled out and crushed.

Obscure Scale.—Pecans in the Mississippi River Valley and Texas are commonly infested with this pest

and it is rarely found on pecans in the Southeast. Scale is not readily seen until it is scraped away, leaving round white scars where the individual insects settle down to suck juice from the bark. Limbs and twigs become encrusted, with resulting weakening and death.

To control obscure scale it is necessary to spray with oil emulsion in the dormant season, usually a spray con-



taining two percent oil is used. If trees have not been too weakened by the scale, three percent may be used to better advantage.

Twig Girdler.—Of the numerous wood borers in pecan trees, the twig girdler is one of the best known. It is a long-horned beetle which neatly prunes branches the thickness of a lead pencil in late summer. Eggs are laid in the cut portion. Besides pecan, hickory and persimmon are commonly infested. A young orchard planted near forests or old pecans may be severely attacked; the loss on bearing trees is not serious. All twigs should be picked up and burned every winter to prevent

an increase from year to year. Sometimes it is necessary to spray young trees with an arsenical to stop the beetles when they start work.

Flatheaded Borer.—Newly planted pecan trees are subject to great damage by flatheaded borers, yellowish worms that tunnel through the bark in zig-zag course and girdle the trees. Full grown borers dig rather deep in the sapwood and transform into metallic-looking beetles. A great many species of trees are attacked by this one species of flatheaded borer.

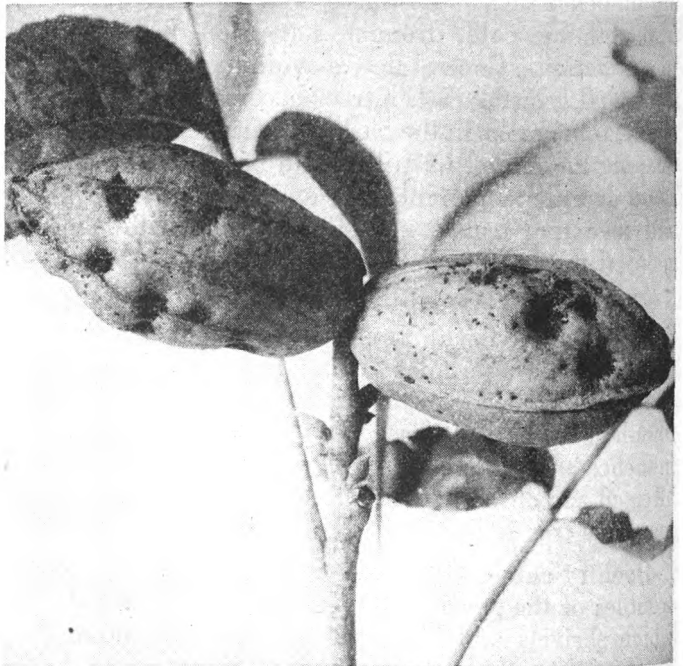
Injury by flatheads invariably follows some weakening influence such as slow growth in the nursery, careless transplanting, cold, drought, starvation, fire, or injury in cultivation. Control lies in avoiding these hindrances to normal growth. When trees become infested and sap oozes from cracks in the bark, cut out the borers at once, opening the tunnel its full length but cutting the sound wood as little as possible. Deep cuts should be painted and then tree trunks may be wrapped with paper to keep off more borers.

Shot-Hole Borer.—The bark of trees is found lightly peppered with round holes about one-sixteenth inch wide. These holes are made by the entrance and emergence of beetles which work in the cambium layer. Shot-hole borers follow severe weakening by some other influence and there is no cure. If an individual limb is affected, cut off and burn; shotholes in the trunk usually mean the tree is dying.

Pecan Scab.—One of the most destructive of all the troubles of the pecan is the fungus disease called scab, which shrivels and blackens the nuts, preventing their proper filling, and causing many to drop. Scab thrives in warm moist weather during spring and summer and is particularly bad in the humid Southeast and Gulf

Coast areas. Varieties vary greatly in their susceptibility—Delmas, Schley, Pabst, Alley, being among the most severely harmed, while Stuart, Moneymaker, Teche, are little or rarely damaged, but no variety can be said to be immune.

To control scab a regular program of spraying with bordeaux mixture must be followed. This consists of one prepollination application of low-lime bordeaux and about three of "standard" bordeaux at three or four-week intervals (see schedule). Supplementary control consists of thinning orchards to allow sunlight to reach



*Courtesy of Bureau of Plant Industry, Soils, and Agricultural Engineering,
United States Department of Agriculture*

PECAN NUTS WITH SCAB INFECTION

between the trees and winter sanitation or the cleanup of shucks and leaves to reduce carryover of infection.

Foliage Diseases.—There are a number of fungus diseases infecting the leaves: brown leaf spot, downy spot, powdery mildew, etc. All are subject to control by spraying with bordeaux mixture and it has been recommended to spray non-scabbing varieties once a year for these leaf diseases. However, it has more recently been found that general stimulation of the trees with fertilizers, cultivation, and necessary thinning, reduces foliage diseases to a negligible point so that direct control is not necessary.

Rosette.—This is one of the deficiency diseases now commonly recognized in plants, caused by a lack of zinc. The foliage first appears mottled with yellow, particularly in the tree tops. Later leaves appear narrowed and crinkled and the foliage is bunched. Eventually shoots die back and trees fail to produce.

Rosette is corrected by mixing zinc sulphate with the fertilizer, one-half to one pound for each year of the tree's age up to 15 years and applying in late winter. Where soils have a high fixing power for zinc, such as some alkaline and heavy-textured soils, rosette can be better corrected by spraying zinc sulphate on the foliage two pounds to 100 gallons of water two or three times a year. On poor sandy soils, low in most plant foods, it is doubtful if zinc sulphate will prevent or cure pecan rosette. In the earlier days of commercial pecan growing in the southeastern part of this country some soils of this kind were planted to pecans. Later it became necessary to abandon the crop causing considerable loss to the investors. Where most of the plant food must be added to the soil it is very difficult to grow pecans at a profit.

SPRAY SCHEDULE FOR PECANS

Name of Spray	Time of Application	Material to Use	Pest to Control	Remarks
1. Dormant spray	January or February	3 percent oil emulsion: 4½ gals. of concentrate (66 percent oil) to 100 gals. of spray	Obscure scale in Southwest and locally in Southeast	If trees show a weakened condition, reduce to 2 percent oil
2. Prepollination spray	April, when leaves are ¼ to ½ grown	Low-lime bordeaux mixture: 4 lbs. copper sulphate, 1 lb. hydrated lime, 100 gals. water	Pecan scab	Do not spray unless temperature is above 55°
3. First cover spray	As soon as tips of nuts have turned brown and pollination is complete	Bordeaux mixture: 6 lbs. copper sulphate, 2 lbs. hydrated lime, 100 gals. water. Add 13 fluid ozs. of nicotine sulphate	Pecan scab Nut case-bearer Rosette	If present. In semi-arid country, 6 lbs. lead arsenate may be used instead of nicotine sulphate. If no soil applications have been made for rosette, add 4 lbs. zinc sulphate
4. Second cover spray	Three to four weeks after No. 3	Bordeaux mixture same as in No. 3. Add 6½ ozs. of nicotine sulphate	Pecan scab Black pecan aphid Rosette	Very thorough application necessary in all parts of tree. Zinc sulphate as in No. 3
5. Third cover spray	Three to four weeks after No. 4	Same as No. 4	Pecan scab, black aphid, rosette, if necessary	If leaf casebearer or other leaf feeders are serious, add 2 lbs. calcium arsenate

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. How does the pecan nut casebearer differ from the pecan weevil in geographical range?
2. How does the shuckworm differ from both?
3. Which of the insect pests discussed are:
 - a. Lepidoptera; caterpillars when immature, moths when mature?
 - b. Coleoptera; grubs when immature, beetles when mature?
 - c. Hemiptera; bugs or sucking insects?
4. What fungus diseases of pecan are named?
5. What deficiency disease is discussed, and how is it corrected?
6. For which insects are sprays recommended?
7. For which insects are other means of control recommended?
8. How is pecan scab controlled?
9. What are the important pecan pests of your locality?

SUGGESTED EXERCISES

1. Make a collection of pecan insects and diseases and identify each. Mail specimens of those you are unable to identify to your experiment station for identification.
2. Visit nearby pecan orchards and study methods of spraying and spray outfits used for the control of pecan insects and diseases.

CHAPTER XXII

PECANS—HARVESTING AND MARKETING

Job 9—Harvesting Pecans

Pecans will withstand rougher handling than most orchard fruits; however, the grower is well repaid for using care in harvesting.

When the hulls of the nuts begin to open in the fall and a considerable number begin dropping to the ground it is time to start harvesting.

Men with long bamboo poles gently tap the clusters of nuts where the hulls are beginning to open. One man may climb the tree and knock down the nuts which are too high to be reached from the ground. The nuts are then gathered from the ground by pickers who put them in sacks which are carried by means of a shoulder strap. Some separate the few clinging hulls from the nuts as they are picked up, while others wait until the nuts are carried to shelter before taking out the hulls. Separating the pecans from the hulls is termed "shucking pecans."

The grower makes from two to three harvests in gathering a season's crop. It is best to harvest the pecans as promptly as possible after they are ready in order to prevent waste and thievery.

The price paid for harvesting pecans varies with labor conditions and prices of nuts. From one to two cents per pound is usually paid. A laborer will gather from 75 to 200 pounds of pecans in a day. When harvested, the pecans are either spread in the sunshine for a few days to dry or are sent to some selling agency equipped

with drying rooms where the nuts are dried by steam or hot air.

Grading Pecans.—Unless pecans are graded they must be sold as “orchard run,” and consequently bring a lower price. Grading by hand is too slow and tedious to be practiced only where very small quantities are to



SCHLEY PECANS

Courtesy of G. C. Starcher

be handled. Good grading machines cost from \$500 to \$700 and are too expensive for the smaller individual grower. The small grower, however, can market his pecans through some cooperative marketing association and have them graded by the marketing agency.

Pecan Yields.—The ages of pecan trees are counted from the time they are set to the orchard rather than from the time the nuts are planted or from the time the trees are budded or grafted.

They frequently bear a few nuts here and there the third year after being planted to the orchard; however, it is usually from eight to ten years before commercial crops are expected.

Five commercial varieties of pecans planted at the Georgia Experiment Station in January, 1908, had produced the following average total per tree at the close of the 1921 harvest:

Alley	123 lbs.
Frotscher	113 lbs.
Moneymaker	173 lbs.
Pabst	126 lbs.
Teche	124 lbs.

Some of the large native seedling pecan trees of Texas are recorded as having produced more than a thousand pounds of pecans in a single year and averaged over 300 pounds per year for a period of 15 years or more. However, the records of high-yielding individual pecan trees serve only to show the possibilities of pecans, for the average yields per tree of commercial pecan orchards fall far short of such records.

Job 10—Marketing Pecans

Pecans are sold in two forms: (1) whole pecans, and (2) pecan meats. The choice varieties are sold without cracking while the culls from choice varieties, inferior varieties, and seedlings supply the pecan meats for candy making and other culinary uses.

Varieties of pecans will average about 50 percent shell and 50 percent meat. The meat contains from 60 to 70 percent oil. Pecan meats should consequently sell for more per pound than whole pecans.

In marketing pecans the same general principles are observed as outlined for marketing peaches. However, these principles must be applied to the specific job of marketing pecans.

Packages for Pecans.—Mail order shipments are usually made in pasteboard cartons holding from one to five pounds. Some of the marketing organizations use boxes holding 50 pounds of pecans, while the barrels, holding about 175 pounds, remain popular with a large number of pecan growers and dealers. The bag,

single or double, is an unsatisfactory receptacle for shipping pecans and its use is generally discouraged.

Cold Storage Necessary in Marketing Pecans.—

When pecans are held in storage at high temperatures the oil in the meats gradually becomes rancid, making the nuts undesirable for food. Unless the crop is sold during the winter following its harvest, the nuts should be placed on cold storage before the weather becomes warm the following spring. The best temperature for storing pecans has not been determined definitely but from the limited amount of work done along this line, it is thought that a temperature ranging around 40° F. is about correct. If held at this temperature, the pecans may be held through the summer and marketed the ensuing fall when there is a demand for them. There is a limited demand for pecans during hot weather. Pecan meats are more in demand during the winter months.

Why Cooperative Marketing Associations Were Organized.—The limited production of improved varieties of pecans during the early years enabled the individual growers to sell their crops in small packages by mail and express shipments. As the industry grew beyond the feasibility of handling the crop by this method it became more difficult to sell a large tonnage of pecans. Consequently, the growers began to organize themselves into cooperative marketing associations. These marketing associations employ efficient market men who can sell a large crop much more readily than the individual.

Cooperative Marketing Associations.—The cooperative marketing organizations for selling pecans are operated in essentially the same manner as cooperative associations for marketing other agricultural commodities.

The National Pecan Growers' Exchange.—The methods of operation of the National Pecan Growers' Exchange may be summarized to indicate how a cooperative organization markets pecans.



Courtesy of G. C. Starcher

TREES PROPERLY SPRAYED HOLD FOLIAGE UNTIL NUTS MATURE

The plan of the National Pecan Growers' Exchange is to establish an exchange at some central point and then establish sub-exchanges in other producing centers which warrant the erection of a building equipped with curing, grading, and packing facilities of the nuts for shipment. The Exchange is controlled by a Board of Directors. The sub-exchanges can elect representatives who have the privilege of participating in the deliberations of the Board of Directors. Every member, regardless of the tonnage of nuts he delivers to the Exchange, has one vote in all matters governing the Exchange.

In late September or early October of each year the members of the Exchange are invited to meet and agree upon prices to be charged for pecans the ensuing season. Care is taken that these prices shall be fair to both the seller and the buyer.

The Exchange solicits orders for pecans during the summer preceding the harvest. The orders are accepted subject to the approval of the purchaser to the price of pecans to be fixed by the Exchange. The Exchange guarantees the purchaser against a reduction of the opening price by the Exchange.

When the pecans are received from the orchards they are placed in an air-heated drying room where the excess moisture is driven off. These pecans are next passed through a grading machine which usually separates them into four sizes: jumbos, ones, twos, and threes. The nuts are packed according to grades and sold. Boxes holding 50 pounds of pecans are used for shipping. The shipping package is changed from year to year according to the requirements of the market.

The Exchange, being a non-profit selling agency, deducts only the actual cost of making the sales. This cost varies from year to year but ranges from four to five cents per pound of nuts sold.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. When should the harvesting of pecans begin?
2. How are pecans harvested?
3. What is meant by the term "shucking pecans"?
4. How many harvests are usually made during the season?
5. How many pounds of pecans will a laborer pick up in a day and what is the customary price per pound?
6. In what kind of packages are pecans usually shipped?
7. What are some of the advantages in grading pecans for market?
8. From what time is the age of pecan trees counted?
9. When do pecan trees begin bearing?
10. In what two forms are pecans sold?
11. What percentage of shell do most varieties of pecans contain?
12. What percentage of oil does pecan meat usually contain?
13. Why should pecans be held in cold storage?
14. At what temperature should the rooms for pecans in cold storage be held?
15. What are some of the advantages of cooperative marketing associations in selling pecans?
16. How does the National Pecan Growers' Exchange operate?

SUGGESTED EXERCISES

1. Visit nearby pecan orchards and study the methods of harvesting and storing the nuts practiced by the growers.
2. Make a collection of packages used for shipping pecans and study the strong and weak points of each.
3. Get into communication with the different marketing organizations handling pecans and study the methods employed in marketing this crop.
4. Visit a pecan shelling plant, note methods of shelling and packaging the meats as well as prices received by the sheller. Trace pecan meats as to uses for human food and prices the consumers pay.

SEASONAL WORK FOR PECANS

September, October, and November

1. Sow a cover crop in the orchard. Harvest and market the crop as the nuts ripen.
2. Clean up and destroy fallen, immature or diseased nuts and hulls to reduce insects and diseases attacking nuts the next season.
3. Place order for nursery trees to be delivered in December or January.
4. Wrap pecan trees under six years old to the crotch with sacks to prevent winter injury or sour sap.
5. Prepare land for any additional land to be set to pecans.

December, January, and February

1. Set out young pecan trees.
2. Make preparations and crown graft pecan trees in February.
3. Prune out dead and broken limbs of the pecan trees. Procure fertilizers for the coming season.

March, April, and May

1. Fertilize and begin orchard cultivation.
2. Prepare spray outfit and provide necessary materials for spraying when necessary.
3. Begin spring budding if dormant wood buds are to be used.

June, July, and August

1. Continue to bud if nursery trees are to be propagated.
2. Keep the pecan orchard cleanly cultivated.
3. Take necessary steps to control insects and diseases. Arrange with some marketing agency for marketing the crop of nuts.

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CHAPTER XXIII

GRAPES—SELECTING SITE AND PLANTING

Job 1—Selecting the Site for a Vineyard

The ideal site for a vineyard depends somewhat upon the class of grapes to be grown. The grapes commonly grown in the South may be divided into two groups: (1) the bunch grapes, classed as Euvitis and represented by such well-known varieties as the Concord and Delaware; and (2) the muscadine grapes, classed as Muscadiana, and represented by such varieties as the Scuppernong, James, Thomas, and Flowers.

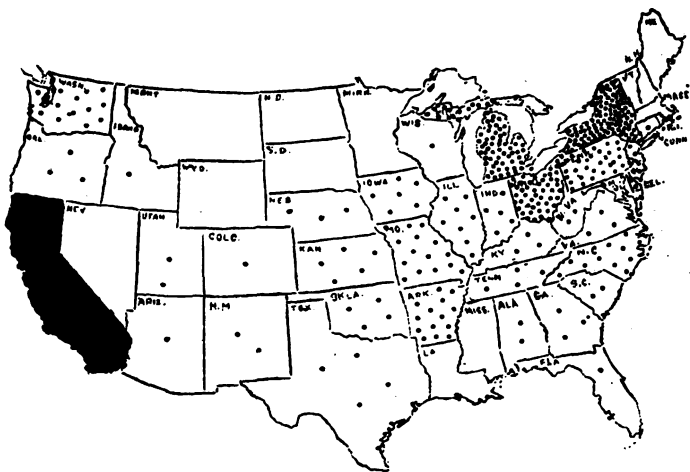
The bunch grapes are better adapted generally to the more elevated regions, that is to the Piedmont and Appalachian Highlands; while the muscadine grapes are better adapted to the Coastal Plain. However, varieties of both these groups are being grown practically all over the South.

The following factors should be considered in the location of a vineyard: (1) suitability of the crop to the region, (2) soil adaptation, (3) whether the fruit is to be marketed or consumed at home, (4) accessibility to markets if the fruit is to be sold, and (5) labor supply.

Soils for Grape Production.—Grapes will grow well on practically all soil types from the light sandy loams to the heavy clays. Regardless of the type, the soil must be well drained and its fertility maintained for the production of satisfactory crops of grapes.

The grape produces its fruit on new growth and con-

sequently blossoms later than such fruits as peaches and plums which have their fruit buds on the preceding year's growth and bloom before putting out leaves. For this reason the grape is not as likely to be killed by late spring frosts as some other fruits. Even with its late blooming, the grape is not entirely free from spring frost



GRAPE PRODUCTION IN THE UNITED STATES
Each dot represents 1,000,000 pounds.

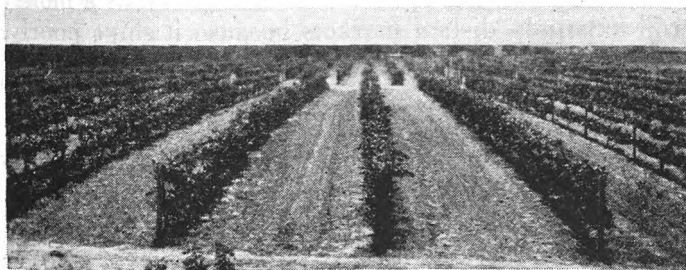
injury and should be planted on elevated areas with good air drainage.

The Relation of Location to Marketing.—Marketing the fruit is one of the big problems of the grape grower. The two chief outlets for his crop are: (1) markets for the fresh fruit which is used for dessert purposes or for "table grapes," and (2) the production of grape juice.

Unless the vineyard is located near a city or some manufacturing center where the grapes can be sold lo-

cally, shipping the crop will be necessary. If the crop is to be shipped, it is important to locate the vineyard near a main line of railroad so that distant markets can be supplied without difficulty.

How Much Land to Plant to Grapes.—Grape growing requires a great deal of hand work. Also the building of trellises on which the vines grow becomes a



TEN-YEAR-OLD MUSCADINE GRAPE VINEYARD

very expensive item in large vineyards. For these reasons commercial vineyards seldom reach the size of commercial orchards of peaches, apples, and pecans. The individual grower must decide just how many acres of grapes he can handle. As a rule, small vineyards located near cities or large centers of population are most profitable.

Grapes as a Money Crop.—Grapes can be made one of the important money crops of the farm. Several varieties of the bunch grapes can be shipped to distant markets, while both the bunch and muscadine grapes can be sold in the local markets. Where frequent deliveries of farm products are made, a number of varieties of grapes may be grown with other fruits and truck crops

in order to extend the season and to satisfy those customers desiring a variety of fruits and vegetables.

Muscadine Grapes as a Money Crop.—Muscadine grapes do not bear shipping well and are slightly impaired in flavor as early as six hours after they are harvested. They are at their best when picked from the vines, but they can be harvested and put on nearby markets without any great amount of deterioration.

The muscadine grape has not been grown as a money crop to supply distant markets because it ships poorly.



\\ Lines Represent Area over Which Bunch Grapes Are Grown

/// Lines Represent Area over Which Muscadine Grapes Are Grown

For the same reason, this industry has not developed along with the growing of apples, peaches, and oranges. *Any fruit which is consumed almost entirely by the producers seldom, if ever, reaches a high stage of development.* The muscadine grape is no exception to this rule. It is only the crop of extensive

commercial importance which attracts sufficient capital and labor to develop it to the point of supplying the great masses of people in other sections and in other professions. For example, what would the peach industry amount to if the people in the peach districts were the only consumers of the peaches?

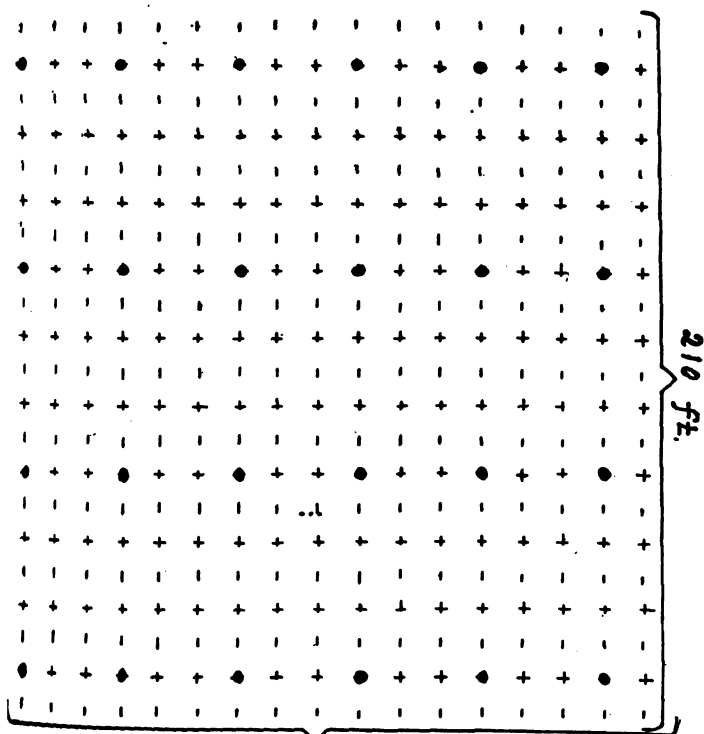
Manufactured Grape Products as Money Crops.

—The sale of muscadine grapes can be extended greatly by making them into salable products, such as wines, unfermented grape juice, preserves, and jellies.

Job 2—Planting the Vineyard

Having chosen a location for the vineyard, the next step is to prepare the soil for setting the vines. The land should be well broken to the depth of from seven to ten inches and harrowed down smoothly.

Laying Out the Vineyard.—If the land is fairly



(+) = VINES
 (I) = POSTS
 (O) = Male Vines

210 ft. { Rows 12 ft. Apart
 Vines 20 ft. Apart

THE NUMBER OF MUSCADINE GRAPES FOR AN ACRE

level, it should be laid out in checks. This can be done by the method described for laying out a peach orchard. Where extreme accuracy is not insisted upon, the land may be checked off by the use of stakes by a good plowman with a mule and plow, just as corn and cotton rows are laid off. If the land is rolling, the rows should be run with the contour of the hill to prevent washing. This work can be done also with a fair degree of accuracy by a good plowman and mule.

If the rows are to be long, cross roads or alleys about 20 feet wide should be left across the vineyard about 500 feet apart. These will aid in hauling out fruit and prunings, and will facilitate spraying operations.

Distance to Plant Grapes.—Varieties of grapes that make a rank growth require more space than weak or small growing varieties. Muscadine grapes require much more space than bunch grapes.

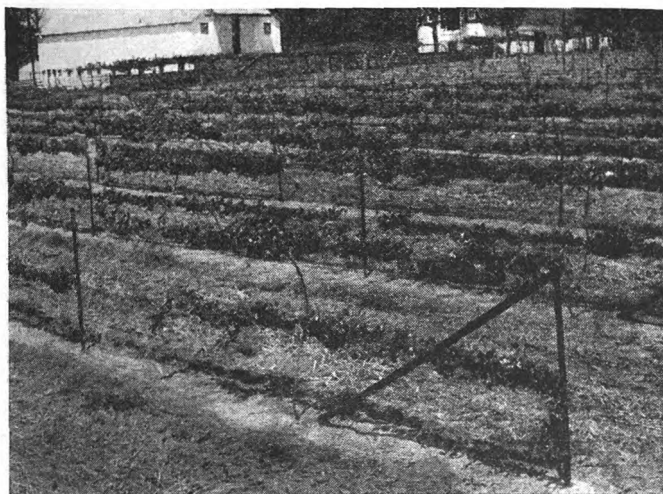
A very satisfactory distance for most varieties of bunch grapes that are to be trained by the vertical trellis system is to space the rows ten feet apart and set the vines nine feet apart in the row. Set at this distance, it will require 484 vines to plant an acre. In putting up the trellis for this spacing, the posts are set 18 feet apart, which allows 2 vines in each space between the posts.

The rows for muscadine grapes should be spaced from 12 to 15 feet apart and the vines set from 20 to 24 feet apart in the row. If the rows are spaced 15 feet apart and the vines set 21 feet apart in the row it will require 140 vines to plant an acre. At this distance, only one vine is set in each space between the posts which are set 21 feet apart for the trellis.

If the vines are to be trained by the overhead or arbor system, they should be set 20 feet apart each way.

Securing the Vines for Planting the Vineyard.

—The vines for planting a vineyard may be propagated at home by methods described in the next chapter or they may be purchased from a nursery. As a beginning, it is more convenient usually to purchase the rooted vines from a nurseryman who propagates desirable varieties under their correct names. After the vineyard is once established it is well for the grower to maintain a



THREE-YEAR-OLD MUSCADINE GRAPE VINEYARD WITH COVER CROP
OF RYE HARROWED IN

small nursery in order to replant any missing places in the vineyard or to extend the plantings if desired.

In buying grape vines, as in buying other nursery stock, it is well to buy them from the nearest nursery supplying good plants at reasonable prices.

Varieties to Buy.—The purpose for which the grapes are to be used will determine largely the variety or varieties to buy. The following list gives some of the

best varieties recommended for growing in the South.

All the varieties named below are suitable for home use and nearby markets, and some are suitable for shipping also.

VARIETIES OF BUNCH GRAPES FOR THE UPPER SOUTH

Variety	Color	When Ripe	Quality
Brilliant.....	Red	Mid-July	Excellent
Moore's Early *.....	Black	Mid-July	Good
Delaware *.....	Red	Mid-July	Excellent
Concord *.....	Black	Late July	Good
Niagara *.....	White	Late July	Good
Catawba.....	Red	Early Aug.	Very Good
Lucile.....	Red	Mid-July	Fair
Ellen Scott.....	Red	Early Aug.	Fair
Bailey.....	Black	Early Aug.	Good
Extra.....	Black	Early Aug.	Excellent

VARIETIES OF GRAPES FOR COASTAL PLAIN

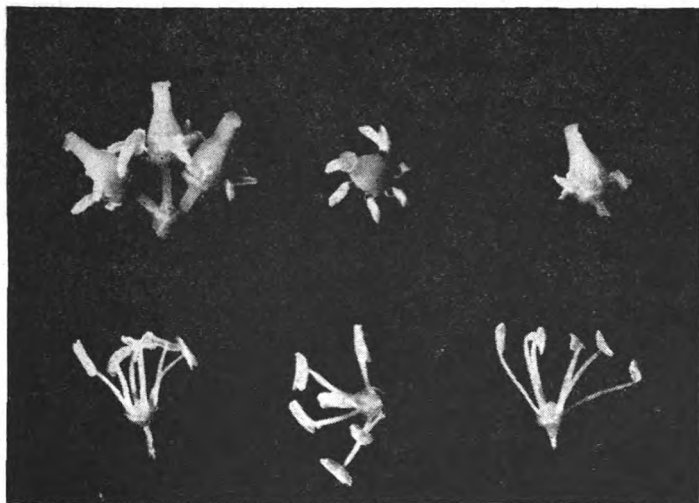
Variety	Color	When Ripe	Quality
Morrel Seedling.....	Red	Late July	Good
Carman.....	Black	Early Aug.	Good
Beacon.....	Black	Early Aug.	Good
Concord *.....	Black	Late July	Good
Brilliant *.....	Red	Mid-July	Excellent
Niagara *.....	White	Late July	Good
Thomas (muscadine).....	Black	Late Aug.	Excellent
Scuppernong (muscadine)...	White	Late Aug.	Very Good
Yuga (muscadine).....	Black	Late Sept.	Fair
Creek (muscadine).....	Black	Late Aug.	Excellent
Hunt (muscadine).....	Black	Late Sept.	Excellent

*Good for shipping.

Sterility in Grapes.—It has been found that a few varieties of bunch grapes and practically all of the muscadine grapes are self-sterile; that is, they are incapable of fertilizing their flowers with their own pollen. The Brighton is one of the varieties of bunch grapes that is almost entirely self-sterile. It should be grown near the Concord, Niagara, or some other variety which is self-

fertile and will pollinate both its own flowers and those of the Brighton.

The blossoms of the muscadine grapes, including the Scuppernong, Thomas, Yuga, and Creek, produce pol-



BLOSSOMS OF MUSCADINE GRAPE

Upper, female or pistillate flowers; lower, male or staminate flowers.

len, but the pollen grains are merely empty shells and are entirely incapable of pollinating the blossoms of any variety.

Male Muscadine Vines.—The pollen which pollinates our muscadine varieties is produced by staminate or male muscadine vines. These male vines produce flowers, but no grapes whatever. The pollen is carried from the male or staminate vines to the female or pistillate vines by small wasp-like insects and sweat bees. Hedge rows and the forests contain many male vines from which insects bring the pollen for pollinating Scup-

pernong vines and others of this group of grapes. When muscadine grape seed are planted, approximately one-half of the seedlings will be male and one-half female.

How to Distinguish the Male from the Female Vines.—The only way the male vines can be distinguished from the female vines is by their flowers. The female vines produce small flowers with short stamens or flower parts. The male flowers are much larger and have long spreading stamens or flower parts.

Use Male Vines for Pollinators in a Muscadine Vineyard.—In order to produce good crops of grapes it is best to grow the male vines in the vineyard rather than to depend upon those in the woods to supply the pollen. Rooted layers from heavily blooming male vines, which bloom at the same time the female vines do, should be selected.

How to Arrange the Male Vines in the Vineyard.—A very good arrangement is to place one male vine as every third vine in each third row, indicated as follows:

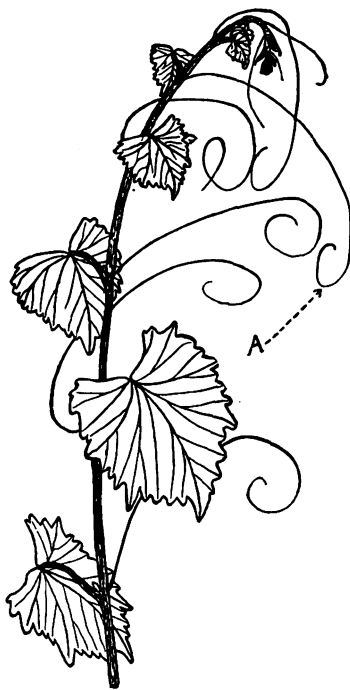
F	-F-M-F	-F-M-F	-F-M-F	-F-M
F	-F-F-F	-F-F-F	-F-F-F	-F-F-F
F	-F-F-F	-F-F-F	-F-F-F	-F-F-F
M	-F-F-F	-M-F-F	-M-F-F	-M-F-F

How to Foretell the Color of Muscadine Grapes When the Vines Are Young.—If the tendrils or curls and young leaves of a muscadine grape vine are of a reddish or bronze color, its grapes will be black. If the tendrils and young leaves are of a solid light green color, the grapes will be white or of the Scuppernong color. By such an examination the grower will know, even when the vines are very young, whether he has a white or a black variety.

Size and Age of Grape Vines to Plant.—Only the vigorous and young vines free from insects and diseases should be planted.

In planting bunch grapes, select the largest and most stocky plants of the one-year vines rooted from cuttings.

It is best to use two-year muscadine vines for planting. This is because they are usually rooted from layers and the rooted layers are not detached from the parent vines until the fall or winter after the layers are made in summer. These rooted layers live better and start into growth quicker if grown in the nursery for one year before being set to the vineyard. If the grower propagates his own vines they may be allowed to remain in the nursery and be taken up as needed for planting in the vineyard. If they come from a nursery and arrive before they are to be planted, the bundles should be untied and the vines heeled-in in moist soil until needed for planting. It is important that the roots not be allowed to become dry.



A GROWING SHOOT OF A MUSCADINE GRAPE VINE

If the tendrils (a) are full green the grapes will be white or nearly so; if the tendrils are red or purple the grapes will be black or nearly so. The color must be noted while the growth is young.

When to Plant Grape Vines.—Grape vines may be planted at any time during the dormant season, from November to March, depending upon the location. December and January are the best months for doing this work.

How to Plant Grape Vines.—On well-prepared land which has been marked off with a plow, it will be necessary to remove only one or two shovelfuls of soil to make a hole large enough for setting the vine. If the soil is rather moist, no water will be needed in the holes. The holes need be only large enough to allow the roots of the young vine their natural spread. Two men working together can do the job very quickly. One digs the hole with a shovel and the other trims off the broken or bruised roots and puts the vine in place. The man holding the vine packs the soil around the roots while the man with the shovel fills the hole. When the hole is almost full, the packing is stopped and the remainder of the hole filled with loose soil.

The young vines should be set about two inches deeper than they stood in the nursery.

Cutting Back the Young Vines.—As soon as the planting is finished the vineyard should be gone over and the vines cut back to only two joints or nodes above the soil. From the buds of these nodes the first year's growth of the young vines is made.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. What are the two general groups of grapes grown in the South?
2. Which of these is best adapted to the Coastal Plain and which to the highlands?

3. Which blooms first, grapes or peaches? Why?
4. On what type of soil do grapes grow?
5. How should the vineyard be located with reference to marketing grapes?
6. How do vineyards compare in size with peach, apple, and pecan orchards?
7. How can grapes be used as a money crop?
8. Why are muscadine grapes not shipped long distances?
9. Why is muscadine grape growing so little developed commercially?
10. How should land be prepared for starting a vineyard?
11. Tell how the rows are laid out and give the use of cross roads or alleys in the vineyard.
12. What distance apart should bunch grapes be planted?
13. What distance apart should muscadine grapes be planted?
14. Where should nursery grape vines be purchased?
15. Name a few varieties of bunch grapes and muscadines adapted to the South.
16. What is sterility in grapes?
17. Which are generally self-sterile, the bunch grapes or the muscadines?
18. How is a male muscadine vine distinguished from those which produce grapes?
19. How many male vines should be set in a muscadine vineyard and how should they be arranged?
20. What are the colorings of muscadine vines which foretell the color of grapes?
21. What kind of bunch grape vines would you choose for planting? What kind of muscadine vines?
22. When and how should grape vines be planted?
23. How should young vines be cut back after planting?

SUGGESTED EXERCISES

1. Visit the vineyards near your school and note the kinds grown, whether muscadine or bunch grapes.
2. Examine the soil type found in the vineyards and learn from the owner which are best for grapes in that region.

3. Inquire from the vineyard owner how the fruit is marketed, and how the profits from grape growing compare with those from other fruits.
4. Draw a plan for a vineyard of bunch grapes to cover ten acres of land. Include in this plan the varieties you would grow for the market, the number of vines of each variety, distance for planting the vines, and arrangement of cross roads or alleys.
5. Draw another plan for a home vineyard including some varieties of the muscadine grapes, showing arrangement and number of vines you would select for a family of six.
6. Visit some of the vineyards of your community and see how they compare with the plans you have drawn.

CHAPTER XXIV

GRAPES—PROPAGATING AND GROWING

Job 3—Propagating Grapes

Grapes may be propagated from seed, by grafting, from cuttings, and from layers. Propagation from seed is seldom practiced except for the purpose of creating new varieties in experimental work. Grafting grapes is resorted to occasionally in an effort to grow choice varieties, whose roots are susceptible to diseases or insects, on the roots of resistant varieties or seedling vines. In this work the same method of grafting is employed as described for grafting pecan nursery trees.

Propagating Grapes from Cuttings.—Rooting cuttings is the method almost altogether employed in propagating the varieties of bunch grapes, but it is not a successful method of propagating muscadine grapes.

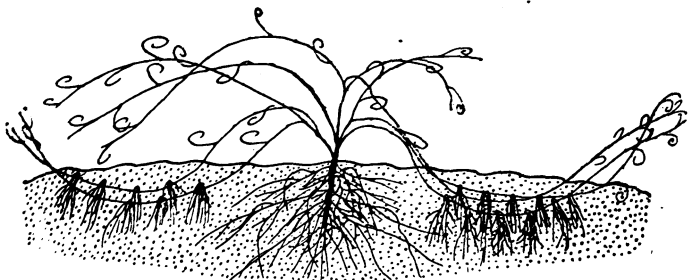
Grape cuttings may be made at any time in the late fall after the leaves shed and during the winter months. In those sections with considerable freezing weather, it is best to make the cuttings in the late fall before the small lateral vines, which are called canes, are winter injured.

Only one-year-old wood should be used for making grape cuttings. The medium-sized and well-matured vines or canes with rather short joints are preferable. The cuttings should contain two or more joints and should be made from 8 to 12 inches long.

The cut at the lower or basal end should be made square across and close to the joint. Since the roots

sprout from the joints of the cuttings, such a cut will afford favorable conditions for a clump of roots to form at the lower end of the cutting when it is set in the nursery. The cut at the small or upper end of the cutting is made with a slope and about one and one-half inches above the joint to prevent the bud at the end from drying out.

The cuttings may be set in the nursery as they are made; or they may be tied in bundles with small wire



METHOD OF PROPAGATING THE MUSCADINE GRAPE BY LAYERS

(strings will decay), properly labelled, and buried in moist sand until late winter or early spring and then set.

A fertile, moist, sandy loam soil is best for rooting grape cuttings. If the water level, called "water table," is only three or four feet below the surface, the moisture of the surface soil will remain more constant. It is important that the surface soil be well drained. Such areas of soil can often be found near creeks and ponds of water.

The soil should be broken and laid off into rows from four to five feet apart. A long, narrow plow should be used to make a deep, narrow furrow in which the cuttings are set.

The cuttings are set from five to six inches apart in this furrow with the large or basal ends downward. All

cuttings should be placed at an angle of 45° to prevent possible lifting by repeated freezing and thawing. The soil is packed around the lower ends of the cuttings as they are pushed down into the furrow. Then the furrow is filled in with a plow or hoe or any convenient implement. The soil should come up to the upper buds of the cuttings for this will prevent the cuttings from drying out. If the upper bud fails to grow the bud from the next joint below the surface will often push out and make the top growth.

Cultivating the Young Vines.—As the cuttings start growth in the spring the young vines should be kept cleanly cultivated. It is important that the cultivating implements should not strike the cuttings and disturb the young roots just starting growth at the lower ends.

Propagating Grapes from Layers.—The muscadine group of grapes does not root very satisfactorily from cuttings. For that reason this group is generally propagated from layers.

The most common method of layering grape vines is to lay the new growth of vines or canes into trenches and cover them with soil to a depth of four or five inches. The terminal ends of the canes are left extending from the soil and the basal ends left attached to the parent vine.

The leaves are stripped from that part of the young vine which remains under the soil.

The canes, if put down in July, will form roots at the nodes under the soil and may be taken up in the late fall or early winter.

These rooted layers are cut loose from the parent vine as they are dug up. Those with best developed roots may be planted where the vine is to grow permanently, but much more desirable plants are produced if these

rooted layers are set about twelve inches apart in a nursery row in good soil and allowed to grow there one year before being set to the vineyard.

Job 4—Cultivating the Vineyard

The vineyard is cultivated (1) to destroy weeds, and (2) to aid in the control of insects and diseases.

Roots of the grape vine grow near the surface and consequently, the vine should receive shallow cultivation.

Cultivating to Destroy Weeds.—Early in the spring the soil between the vines should be broken with a turn plow. Near the vines the plow should be run just deep enough to turn the soil, but farther out it should be run deeper. The turning of the soil should be followed by frequent shallow cultivations which should be continued until four or five weeks before the fruit begins to ripen. The number of cultivations given will depend upon the weather and weed growth. The soil should be stirred soon after each rain to prevent a crust from forming.

Cultivation as an Aid in Destroying Insects and Diseases of Grapes.—In addition to destroying weeds, clean culture is an adjunct to the spray pump in the control of insects and diseases. For example, the mummied or dried grapes which carry the black rot disease often fall to the ground in the winter or when the vines are pruned and remain there to infect the new crop of fruit the following summer. When the land is turned these diseased grapes are covered with soil so deeply that the danger of their infecting the new crop is greatly decreased. Large numbers of the larvae of insects which pupate in the soil are destroyed also by cultivation.

Intercultural and Cover Crops in the Vineyard.

—While the grape vines are young, or during the first two years after they are set, crops of vegetables such as cabbage, Irish potatoes, tomatoes, and bush beans, may be grown between the rows of vines. Of course sufficient space should be left between these crops and the vines so that the vines can be well cultivated and will not be over-run by the intercultural crops.

Unless the organic matter or humus content of the soil can be kept up by the use of stable manure, it will be necessary to grow and turn under cover crops for improving the soil of the vineyard.

Cowpeas or soybeans may be used for this purpose. The seed should be sown broadcast at the last cultivation in the summer and the vines turned under during the late winter or early spring. On the other hand, the cowpeas or soybeans may be omitted and the vineyard sown to rye and vetch or crimson clover in September. The rye, vetch, and clover are allowed to grow during the winter and are turned under the following spring.

Fertilizing Grapes.—If available, the vineyard should receive a broadcast application of stable manure every other winter or early spring. From 15 to 20 tons to the acre should be used. This treatment should be supplemented with commercial fertilizers.

*The amount and kind of commercial fertilizers used for grapes will depend upon the needs and type of the soil. For average conditions, a fertilizer containing 8 percent nitrogen, 6 percent phosphoric acid, and 6 percent potash should be satisfactory for grapes.

Following is a mixture with the above analysis. However, mixtures may be made from other ingredients to give the same analysis if desired.

Acid phosphate 16%	750 lbs.
Nitrate of soda 16%	750 lbs.
Muriate of potash 50%	240 lbs.
Filler (sand or dry earth)	260 lbs.

Total	2000
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Some growers prefer one-half the nitrogen to be derived from a slowly available form and the other half from a quickly available form. The nitrogen on all soils may be varied according to the amount of cover crops turned under.

How Much Fertilizer to Use.—The grower must watch the condition of his vines to determine the quantity as well as the kind of fertilizer to use. If the vines become too rank, the number of pounds and the percentage of nitrogen may be reduced. On the other hand, if the vines show a lack of vigor, the quantity of fertilizer applied and the percentage of nitrogen in the mixture may be increased. An application of from 600 to 800 pounds to the acre should keep the vines in a vigorous condition, provided the vineyard is kept well cultivated and the insects and diseases are controlled.

When and How to Apply the Fertilizers.—Stable manure may be put on the vineyard at almost any time during the winter or early spring. The commercial fertilizers should be applied in the spring after the soil has been turned and before the first cultivation.

For the first two years after setting, the fertilizer may be applied in a circle around the vines. It should not come closer than six or eight inches of the base of the vine and should extend out about four feet.

After the second year the roots of the vines will occupy the entire area so completely that the fertilizers may be applied broadcast.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Name four methods by which grapes are propagated.
2. Which of these methods is most commonly used?
3. When should grape cuttings be made?
4. What kind of wood should be made for grape cuttings?
5. When should grape cuttings be planted in the nursery?
6. What kind of soil is used for planting grape cuttings?
7. Tell how grape cuttings are put out?
8. How would you propagate grapes by layering?
9. What are the two chief objects in cultivating the vineyard?
10. How does cultivation destroy insects and diseases?
11. What crops should be grown in a vineyard?
12. What cover crop should be used in a vineyard?
13. How much stable manure per acre should be used in fertilizing a vineyard?
14. What kind of commercial fertilizers should be used and how much should be used per acre? When should it be applied?

SUGGESTED EXERCISES

1. Make cuttings from both bunch and muscadine grapes. Place both in a nursery and record the number of each which root.
2. Visit nearby nurseries and study their methods of propagating grapes.
3. Make layers of muscadine vines and note the number which root in comparison with the number of muscadine cuttings which root.
4. Visit nearby vineyards and study the methods of culture used by the owners. Study the cultivating implements used and note the depth the soil is cultivated.
5. Study the methods of fertilizing and the kind of cover crops used in the vineyards of your community. From

your study of cover crops in general, see if you can suggest some which are better than those now in use.

6. Get prices on fertilizer materials recommended in your text for fertilizing grapes and see how this compares in cost with a ton of the same analysis bought as ready-mixed fertilizers.

CHAPTER XXV

GRAPES—TRAINING AND PRUNING

Job 5—Training and Pruning Grapes

Grapes are pruned according to the way the vines are trained. The bunch grapes are commonly trained (1) on trellises, and (2) on single posts. The muscadine grapes are commonly trained (1) on trellises, and (2) on arbors.

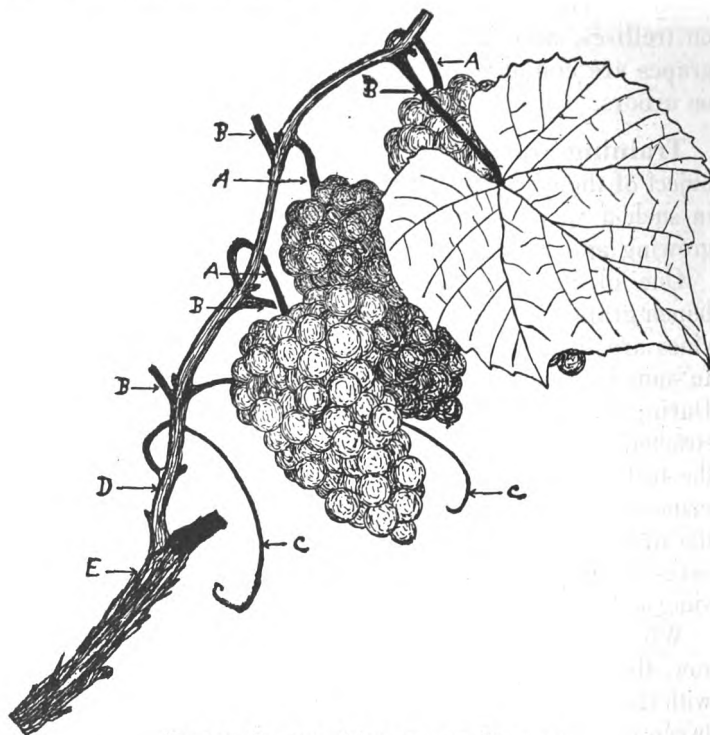
Training and Pruning Bunch Grapes.—It is the object of the grape grower to support and train his vines in such a way as to provide favorable conditions for growing and harvesting maximum crops of good fruit.

One of the most satisfactory methods of training bunch grapes is on a two-wire trellis. The first year the vines are tied up to single stakes about four feet high. In some instances they are allowed to go without staking. During the following fall or winter the trellises are constructed. It will usually prove economical to construct the trellis soon after the vines are planted. The permanent framework of the vine can be established during the first season if the trellis is already in place. This saves a great deal of time in the establishment of the vineyard.

Where the grape vines are set nine feet apart in the row, the posts are spaced 18 feet apart and set in line with the vines. This allows two grape vines to come between each two posts. The posts are set 18 inches deep in the ground and allowed to extend 5 feet above the ground. The end posts should be larger and longer so

that they may be set two and a half or three feet in the ground. They should be well braced to stand the strain of keeping the trellis wires tight. Good posts which will last a long time should be used for trellising grapes.

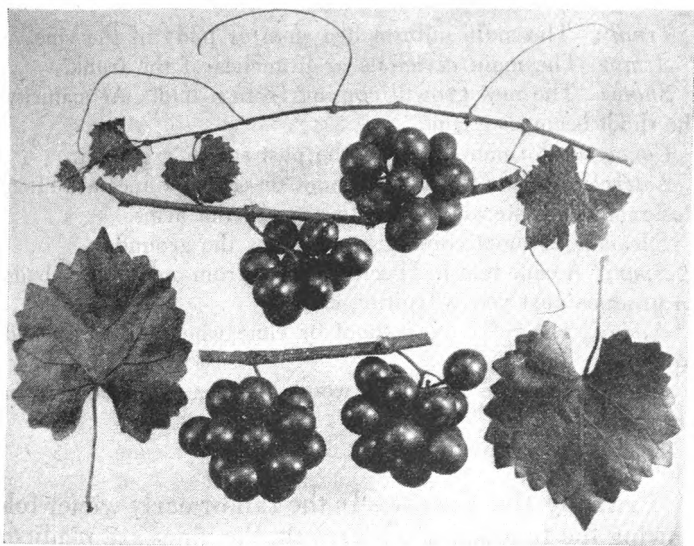
Putting up the Wire.—No. 10 smooth wire is a very satisfactory size for a grape trellis. This size contains 22.3 feet to a pound and requires about 400 pounds to put up an acre of two-wire trellis where the rows are ten feet apart.



BUNCH GRAPES, METHOD OF BEARING

(a) How the bunches are attached; (b) leaf stalk; (c) tendril; (d) new wood growth; and (e) old wood growth.

The lower wire is placed two feet above the ground, while the top wire is fastened only about four inches from the top of the posts. The wires are fastened to the line posts with staples which are not driven in completely in order to allow for tightening the wires when they begin to sag. The wires should be fastened to the



TWIGS, LEAVES, AND CLUSTERS OF THE YUGA, AN IMPROVED VARIETY OF MUSCADINE GRAPES

end posts in such a manner that they can be tightened when necessary. One satisfactory way of doing this is to bore a hole through the end post where the wire is to come. Run the wire through the hole and stretch it tightly with a wire stretcher. Cut the wire off about four or five inches beyond the post and wind the end around a 40-penny, flat-sided nail, called "cut nail." The end of the wire should be wound very tightly around the nail with a monkey wrench until the nail is firmly

against the post. As the wires sag from year to year they can be tightened by giving the nails a few turns with a wrench.

Names of Parts of the Grape Vine.*—In order to understand better a discussion of pruning grapes, definitions of the following important terms are given:

Trunk: The main unbranched stem or body of the vine.

Arms: The main divisions or branches of the trunk.

Shoot: The new growth coming from a bud. At maturity the shoot becomes a cane.

Cane: A dormant shoot of the past season's growth.

Lateral: A side branch or shoot or cane. Canes are often designated as laterals with reference to the arms.

Sucker: A shoot coming from below the ground.

Spur: A cane that has been cut back from one to three buds to produce next year's fruiting cane.

Node: The joint on a shoot or cane where a leaf or bud appears.

Internode: The length of wood between two nodes is an internode.

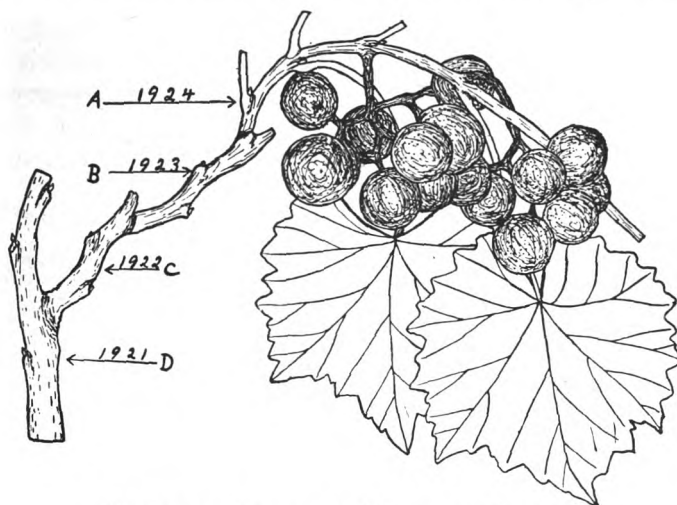
Eye: The compound bud at each node on a cane.

Pruning the Vines.—In the fall or early winter following the first summer's growth, the vines are ready to be pruned and trained to the wires. There are a good many different systems of pruning. Some varieties respond to certain systems of pruning better than to others. For the more vigorous varieties such as Concord and Niagara, the single trunk, four-cane Kniffen system of pruning seems to be the simplest and best.

A single vine is allowed to extend to the first wire without branching. All lateral vines or canes below the wire are cut off. Two laterals or branches, extending in opposite directions, are left near the lower wire and tied

* From Bulletin 208, Missouri Experiment Station.

to the wire; these form the first two arms of the vine. If the main vine or trunk has made sufficient growth, it is extended to the top wire the first season. Here it is allowed to send out laterals in opposite directions which



SYSTEM OF BEARING IN MUSCADINE GRAPES

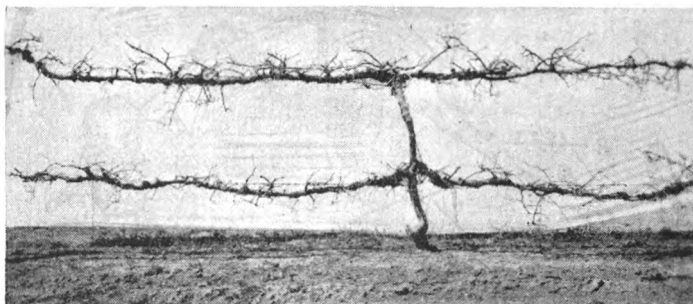
The numbers indicate the years when the wood grew.

form the two upper arms in the same way the arms were formed on the lower wire. Unless the variety is a very vigorous grower the arms for the top wire will not form before the second season.

The trunk under this system is permanent and each year at time of pruning one cane on each side of the trunk both upper and lower vines is selected and cut back to eight or ten buds leaving a total for the four canes of not more than forty buds. Three or four two-bud spurs are left near the trunk for renewal purposes. All other canes except the four selected are pruned from the trunk. It is important that the short renewal spurs

be left so that the canes will arise each year near the trunk and not crowd the adjacent vines.

Training and Pruning Muscadine Grapes.—Muscadine grapes are strong growers and require more



TEN-YEAR-OLD HUNT MUSCADINE VINE PRUNED AFTER FIRST KILLING FROST IN NOVEMBER

space in which to spread than bunch grapes. Also they must be pruned in the fall rather than in the winter to prevent "bleeding" of the vines.

Trellises for Muscadines.—Training the vines on a two-wire trellis has proved much more satisfactory than the old overhead method or arbor training. A trellis is erected for each row of grapes, placing a seven-foot post midway between each two vines. The posts are placed two feet in the ground. The end posts should be eight feet in length and set three feet in the ground, and well braced since they bear an uneven load. Two strands of smooth, galvanized wire are used. Size No. 9 is preferable for the upper wire, while No. 12 may be used for the lower wire. This arrangement is just as efficient and more economical than using No. 10 wire throughout. If practical, the upper wire should be run on top of the posts, and the lower wire stretched two and

one-half feet above the ground. Posts six feet above the ground are probably better in some respects than the five-foot posts, when cost is not considered.

It is recommended and urged that the trellis be constructed in time to begin training the young vines during the first growing season. In some instances, it may be justifiable to tie the vines to stakes for the first year. However, if well-rooted vines are planted correctly in soils of average fertility, even less vigorous varieties will make sufficient growth to warrant the erection of the trellis the first year.

Pruning Muscadine Grape Vines.—The muscadine group of grapes should be pruned from about November 20 to December 20, or immediately following the first killing frost. If the pruning is delayed until midwinter, which is done sometimes in pruning bunch grapes, the vines will “bleed” to excess early the following spring. The heavy flow of sap, when vines are cut in winter, caused the growers to believe for a long time that the muscadine grapes could not be pruned. If large muscadine vines two inches or more in diameter are cut, even in the fall, they tend to “bleed” somewhat when the weather begins to turn warm in the spring. For this reason pruning should begin when the vines are young and followed each year in such a way that the main framework need not be disturbed. The main framework of the vine should be established during the first two or three years after the vineyard is planted. After the framework, consisting of a trunk and four arms, has been established, the vine is pruned annually, cutting the current year’s growth to two or three buds. Small, weak, or over-vigorous canes are removed from the vines since it is the medium-sized canes that are most productive. The pruning cuts should be made close to the main

arms in order to prevent an accumulation of non-bearing wood. The short spur method has been used with much success in pruning experiments at the Georgia Experiment Station.

If an arm dies, or for any reason needs to be replaced, this can be done by choosing the largest cane that has originated near the base of the dead arm and training it to the trellis wire from which the dead member has been removed. All tendrils that have become entwined around the arms should be removed when pruning. These grow to be very tough and encircle the arms tightly, often girdling the arm and causing it to die beyond the point of injury. This unbalances the vine and necessitates the growing of a new arm.

Training Muscadine Vines by the Arbor System.

—Where the vineyard is not pruned and attended carefully, the overhead or arbor system of training has some advantages.

The muscadine or Scuppernong grape arbor is a familiar object to every southern boy and girl. The methods of constructing the arbors or overhead frames vary in details, though the main objects in all of them are to hold the vines off the ground, to allow the vines their natural spread, and to have the fruit within reach for harvesting.

In constructing overhead supports or frames for grapes, it is important to use durable material for grape arbors are very difficult to repair.

Pruning Muscadine Vines on the Arbor.—Muscadine grapes trained by the overhead system are more difficult to prune than when grown on the trellis. However, main vines radiating from the trunk can be established and the laterals or canes pruned out each fall to good advantage.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Name two common methods of training bunch grapes.
2. Name two methods of training muscadine grapes.
3. How is a trellis erected for training bunch grapes?
4. How far apart are the posts set in the row and how far apart are the rows?
5. What kind of wire is used and how much does it require to trellis an acre of bunch grapes?
6. How are the wires kept tight on the trellis?
7. Name the parts of a grape vine.
8. Tell how a grape vine is pruned for training on a two-wire trellis. What is this method of training called?
9. Why are muscadine grapes pruned only during the early fall?
10. How do you erect a trellis for muscadine grapes? Give the spacings of both posts and vines.
11. How are muscadine grapes pruned?
12. How are muscadine grapes trained by the arbor system?
13. What methods of training grapes are used in your community?

SUGGESTED EXERCISES

1. Make a drawing in your note book, giving dimensions of a two-wire trellis for bunch grape vines, and one of a three-wire trellis for muscadine grape vines.
2. Draw a grape vine and label the parts.
3. Visit a nearby vineyard and prune a few vines according to directions given in your text.

CHAPTER XXVI

GRAPES—INSECTS, DISEASES, AND MARKETING

Job 6—Controlling Insects and Diseases of Grapes

The muscadine group of grapes is so resistant to insects and diseases that it has not been found necessary to follow any regular spray schedule for protecting the vines and fruit.

The bunch grapes, however, are attacked by a number of insects and diseases which require systematic treatment.

Grape Insects.—Insects often attack the young vines of bunch grapes before they reach the bearing age. When such attacks occur the vines should be sprayed to give them the proper protection. It is often unnecessary to spray until the vines begin to bear fruit.

The Grape Berry Moth.—The adult of the grape berry moth is a small slate colored moth with reddish brown markings. There are two generations or broods each year. The larvae of the first brood feed on the tender stems and leaves while the larvae of the second brood bore into the grapes. The grape berry moth is the chief cause of "wormy grapes." This insect is controlled by spraying with arsenate of lead and by vineyard sanitation.

The Grape Leaf Hopper and Aphids.—These insects puncture the leaves and tender stems of the grape and suck the sap or juices of the new growth. When observed on the vines they should be destroyed by the

use of a spray solution which comes in contact with the insects. A spray of this kind is called a "contact insecticide."

A mixture made by adding one-half pint of nicotine sulphate and six pounds of fish-oil soap to 100 gallons of water is recommended for spraying against these insects. Care should be taken to spray both the under and upper sides of the leaves to make sure that the solution comes in contact with the insects.

Scale Insects on Grapes.—Scale insects attack grapes much less than they attack such orchard fruits as apples, peaches, and pears. When the vines are known to be infested by scale, they should be sprayed with concentrated lime-sulphur solution during the winter or dormant season.

Diseases of Grapes.—Black rot, mildew, and anthracnose are diseases common to most varieties of bunch grapes.

Black Rot.—It is estimated by successful growers that black rot destroys more grapes than all other diseases combined. The fungus causing black rot lives over winter on the mummied or dried grapes, tendrils, and small vines. In the spring



APHIDS ON MUSCADINE TWIG

the fungus develops spores which infect the leaves, new growth, and fruit of the vines. The disease on the fruit starts as small black spots which spread until the entire grape decays and shrivels. Often only a few grapes on a bunch will be attacked; however, even a few decayed grapes will destroy the sale of the entire bunch. Black rot is controlled by cleaning up the vineyard and spraying with bordeaux mixture. See spray schedule for grapes which follows.

Powdery Mildew.—The powdery mildew disease is indicated by the leaves, fruit, and stems being covered by a white powder-like substance. This disease causes the vines to make a weak growth and the grapes to shed. Bordeaux mixture, used for controlling black rot of grapes, will usually control powdery mildew.

Anthracnose.—This disease is sometimes called the bird's-eye-rot. It attacks the stems, leaves, and fruit. Anthracnose is not generally as troublesome as black rot. A number of varieties of grapes, especially the Concord, are highly resistant to the disease.

How to Control Anthracnose.—Diseased canes should be cut out and destroyed as the vines are pruned. The pruning should be followed by spraying thoroughly with concentrated lime-sulphur mixture of the same strength as recommended for spraying peach trees in winter to destroy San Jose scale. The summer spray for black rot will aid in holding anthracnose in check.

Vineyard Sanitation.—Keeping the vineyard clean and in good order is generally called vineyard sanitation. Unless vineyard sanitation is practiced along with spraying it is very difficult to control insects and diseases of any kind.

Beginning in the fall with the pruning of the vines, all prunings, trash, and rubbish of every kind should be

removed from the vineyard. It is especially important that no dried or mummied clusters of grapes be left on the vines to carry diseases through the winter. Keeping the vines cleanly cultivated by stirring the soil frequently is also an important item in vineyard sanitation.

A Spray Schedule for Grapes.—While it has not been found profitable to spray the muscadine grapes, the bunch grapes require spraying in practically every section where grown.

Even though the insects and diseases common to grapes are not found present, it is known that the bunch grapes are susceptible to them, and spraying is regarded as excellent insurance for the crop. Covering the fruit and foliage of the grape with a spray solution often prevents decay and attack of insects, just as a coat of paint preserves the wood of a house.

The following spray schedule, if combined with vineyard sanitation, should give the vineyard the necessary protection:

<i>When to Spray</i>	<i>Insect or Disease</i>	<i>What Spray to Use</i>
1. During Winter	{ Scale Insects Anthracnose	{ Concentrated lime-sulphur mixture, same as for spraying peaches against scale
2. Just before vines bloom	{ Black Rot Powdery Mildew Anthracnose Grape Berry Moth	{ Bordeaux mixture, 4-5-50, with 1 pound of arsenate of lead powder added
3. Soon after blossoms shed	{ Same insects and diseases as No. 2	{ Same spray as for No. 2
4. When grapes are about half grown	{ Black Rot Anthracnose Berry Moth Leaf Hopper	{ Same spray as for No. 2. Add 6 ounces of nicotine sulphate to each 50 gallons of the spray if leaf hoppers or plant lice are present
5. Two or three weeks after No. 4 or just before grapes begin ripening	{ Same as No. 4	{ Same as No. 4

It may become necessary to increase the number of sprayings for late ripening varieties or during rainy seasons when the spray is washed off the vines soon after it is applied.

Bordeaux Mixture.—Bordeaux mixture, which is composed of lime, copper sulphate (or bluestone), and water, is regarded as the best spray mixture for controlling diseases of grapes. In a 4-5-50 bordeaux mixture, 4 pounds of copper sulphate, 5 pounds of lime, and 50 gallons of water are used to make the mixture.

How to Make Bordeaux Mixture.—To make 50 gallons of bordeaux mixture, weigh out 4 pounds of copper sulphate (bluestone) and dissolve it in a small quantity of hot water, or suspend it in a bag just below the surface of water in a tub. If copper sulphate is poured into cold water it sinks to the bottom where the solution becomes saturated and, consequently, all the copper sulphate does not dissolve. When the copper sulphate has been dissolved, make up the solution to 25 gallons with water in a wooden vessel.

Weigh out five pounds of stone (unslaked) lime or seven pounds of ordinary hydrated lime, the kind sold by dealers in building materials. Slake the lime and make up the mixture to 25 gallons with water.

Stir the two solutions well and then pour them into a third vessel at the same time, stirring vigorously. The copper sulphate solution and the lime water, when poured together, form bordeaux mixture. Coarse particles should be strained out of the mixture as it is put into the spray tank. As copper sulphate solutions attack iron or tin, bordeaux mixture should be made in crock or wooden vessels. Ordinary syrup or vinegar barrels are suitable for this purpose.

Arsenate of Lead Solution.—In spraying grapes the arsenate of lead is usually made into a thin paste with water and stirred into the bordeaux mixture. One pound of arsenate of lead is sufficient for 50 gallons of bordeaux mixture.

If it becomes necessary to spray against some leaf-eating insect or some insect attacking the fruit at a time when it is not desirable to spray against diseases, one pound of arsenate of lead and three pounds of lime are mixed with 50 gallons of water. In preparing this mixture the lime is slaked and made up to 50 gallons with water. The arsenate of lead is made into a thin paste with water and stirred into the lime water. The mixture is then strained through a fine mesh strainer into the spray tank and applied to the vines.

Nicotine Sulphate.—Nicotine sulphate is extracted from tobacco. It kills soft bodied insects, such as plant lice, by coming in contact with their bodies. One-fourth pint of nicotine sulphate is sufficient for 50 gallons of bordeaux mixture.

When it is desired to make a combined spray for grape diseases, grape leaf-eating insects, and soft bodied insects like aphids or leap-hoppers which suck the juices from the grape leaves, the following mixture may be used:

Copper sulphate (bluestone) . . .	4 lbs.
Stone (unslaked) lime . . .	5 lbs.
Arsenate of lead powder . . .	1 lb.
Nicotine sulphate	$\frac{1}{4}$ pt.
Water	50 gals.

Spraying Equipment.—If large vineyards are to be sprayed, the power sprayers recommended for peach orchards should be used. In order to form a fine mist the spray should be applied through nozzles with small openings and under high pressure. An elevated plat-

form for holding the barrels or vats, and a supply of water for making bordeaux mixture in large quantities should be provided. The ordinary barrel pump will serve for spraying small vineyards.

Job 7—Harvesting and Marketing Grapes

Everything should be in readiness for harvesting, packing, and marketing grapes. All necessary packages and extra labor should be provided for in advance, for when grapes ripen they should be handled carefully and promptly.

Harvesting Grapes.—Immature grapes are not well flavored and for this reason must be allowed to remain on the vines until ripe. Most varieties color a number of days before they are mature. For this reason it requires considerable skill to tell just when to harvest. The stems shrivel slightly and the seed turn brown and separate easily from the pulp at this stage. For the novice, tasting the fruit is the surest method of determining when it is ripe. When the pickers once learn the proper stage to harvest they can tell at a glance when it is ready to be picked.

The bunches or clusters should be cut off with sharp shears, and not pulled by hand. As the stems are cut, the fruit should be laid carefully into shallow trays or baskets and handled as little as possible. As soon as the picking trays or baskets are full they should be set under the vines to protect the fruit from the sun until it is hauled to the packing shed.

Picking Muscadine Grapes.—Muscadine grapes are more difficult to pick in clusters than the bunch grapes, for it is the habit of most varieties of muscades for the clusters to shatter when ripe.

When muscadine grapes are to be harvested and shipped for dessert or table purposes they should be removed very carefully from the vines by clipping the stems with shears. The grapes should be placed in small baskets so they will not be crushed.

Since muscadine grapes have the habit of shattering when ripe, they are frequently shaken off the vines onto sheets spread on the ground. This method is used in harvesting from arbors where the grapes are to be used for the manufacture of grape juice or jelly making. When used for these purposes the grapes do not have to be handled so carefully. The trash and leaves which fall with the grapes are removed by means of a blower or fan mill.

Grading and Packing Bunch Grapes.—Bunch grapes are usually divided into two grades: first grade, and culls. The first grade grapes are packed into small baskets and sold as table grapes, while the culls are sold for making grape juice or for culinary purposes. Grapes for the first grade must be in bunches of uniform size; must have few or no missing berries from the cluster; must have fully ripe and evenly colored berries; and must be free of insect injuries, fungus diseases, and broken skins.

After the grapes are brought to the packing shed, they are allowed to wilt about six hours before grading and packing begins. This tends to prevent shattering and enables the packer to pack the baskets with less injury to the fruit.

Packages for Grapes.—Bunch grapes for table use are packed usually in two-quart and four-quart baskets. The muscadine grapes are frequently packed in one-quart strawberry baskets, as well as in the two-quart and four-quart baskets. When packed in the one-quart bas-

kets, they are shipped in 24 quart crates just as strawberries are shipped.

Grapes for the manufacture of grape juice may be handled in bushel baskets or any other convenient receptacles.

How to Pack Grapes for Table Use.—The clusters of grapes should be placed in the baskets with the stems downward. They should fit snugly in the basket and extend slightly above the top so that when the lid is put on, the grapes will be held firmly in place yet the pressure will not be great enough to crush the grapes on top. If the fruit in a basket is not packed snugly, it will not carry well. Moreover, where the grapes are sold by the pound it is economical to pack as many in a basket as possible without injury.

Each grower should have a brand name, which, with his own name and address, should be stamped on each package sent out.

Marketing Grapes.—The same marketing methods applied in marketing peaches and apples may be used in marketing grapes. A high class product, put up in attractive packages, usually finds ready sale.

Where there are several commercial grape growers in one region they usually sell their fruit to better advantage and at less expense by forming a cooperative marketing association for handling the entire crop. Individual growers sometimes find it profitable to grow grapes and sell fresh grape juice. The juice is pressed from fully ripe grapes every second or third day and delivered to drug stores, restaurants, etc., just as milk is delivered. A bushel of grapes will produce about three gallons of juice. Yet a gallon of juice will often sell for fully as much as will a bushel of grapes.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Name some of the insects and diseases that attack grapes.
2. What is vineyard sanitation?
3. What sprays are used for grapes and how many applications are usually given?
4. Tell how to make bordeaux mixture.
5. For what is arsenate of lead used and how is it prepared?
6. For what is nicotine sulphate used and how is it prepared?
7. How would you make a combined spray for grape diseases and insects?
8. What equipment should be used for spraying a vineyard?
9. Why should grapes be allowed to remain on the vines until ripe before harvesting?
10. How should the bunches be removed from the vines?
11. How should muscadine grapes be picked for shipping?
12. How are bunch grapes graded and why are they allowed to wilt before packing?
13. What kind of packages are used for grapes?
14. How are grapes packed in the baskets?
15. How are grapes marketed?

SUGGESTED EXERCISES

1. Visit nearby vineyards and collect specimens of all the insects which you find attacking grapes. Mail specimens of any you are unable to identify to your experiment station and ask for identification with suggested method of control.
2. Study methods of spraying grapes in your community. Secure small quantities of materials and make up some spray solutions in the classroom.
3. Secure some spray pump catalogs and study the mechanism of spray pumps. Make a drawing of a longitudinal section of a spray pump and explain how the spray solution enters and how it is forced out into the spray hose and through the spray nozzles.

4. Study several types of spray nozzles and show what causes the spray to break up into a fine mist when vines are being sprayed.
5. Make a collection of grape baskets and study the advantages and disadvantages of each type for handling grapes.
6. Visit packing houses and study the methods employed in packing grapes. Also note the percentage of culls and for what the culls are used.
7. Visit large markets and study how grapes are handled and sold.

SEASONAL WORK IN THE VINEYARD

September, October, and November

1. Harvest and dispose of the fruit as it ripens.
2. Sow a winter cover crop in the vineyard.
3. Prune all muscadine grapes immediately after first killing frost.

December, January, and February

1. Prune the bunch grapes and make cuttings for propagation.
2. Set grape cuttings to the nursery row.
3. Construct or repair grape trellises and plant young vines where needed.

March, April, and May

1. Turn under winter cover crop, fertilize, and start cultivating the vineyard.
2. Start spraying as outlined in spray schedule.
3. Irrigate or mulch grape cuttings in the nursery, unless the soil has an abundance of moisture.
4. Provide baskets, crates, and extra labor to handle the crop when the fruit ripens.

June, July, and August

1. Continue to cultivate and spray the vines to keep them free of weeds and to protect them against insects and diseases.
2. Harvest and dispose of fruit as it ripens.
3. Pay off debts promptly as the fruit is sold.

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CHAPTER XXVII

FIGS—SELECTING LAND AND PROCURING TREES

Job 1—Selecting the Land for a Fig Orchard

Fig growing for home use and for the local markets is to be highly recommended for all the Gulf Coast states and the South Atlantic states as far north as Virginia. But fig growing on a commercial scale has never succeeded in the Southeast except in isolated instances. Therefore, the grower who contemplates planting figs under field conditions should proceed carefully for five or six years at least before planting on a large commercial scale. Just why the fig will thrive, bear prolifically, and live for upwards of 100 years when planted at the doorstep or against an outhouse, but dies in a few years when planted under field conditions, is still the subject of experimentation. For this reason, fig growing serves better as a side line to general farming or fruit growing than as a chief money crop.

Climatic adaptation, market facilities, and soil adaptation are the three factors that the prospective grower must consider if he would be successful.

Climatic Adaptation.—The fig is essentially a semi-tropical fruit. A native of India, it has been grown since remote Biblical times in Palestine and around the Mediterranean Sea. So common were the fig trees around the houses of those days that the expression "under your own vine and fig tree" became synonymous for home. In the United States, southern California,

and that part of the Gulf states below the fall line seem to be best adapted climatically for growing this fruit. It is cold-killed so frequently north of this line that it is not advisable to plant even the hardier varieties except under protected conditions. This line extends from Wilmington, North Carolina, by way of Columbia, South Carolina, and Augusta, Georgia, up to Macon, Georgia, and hence to Columbus, Georgia, and then to the Mississippi Valley. North of this line they may be set near buildings for protection against the north and west winds or in front of tall fences, and still further north the stems are bent down and buried in the soil for winter protection. It should be borne in mind that fig trees are injured or even killed to the ground by temperatures that do not affect most other fruits of the Temperate Zone when in a dormant condition. After a tree has reached the age of three or four years it withstands temperatures which previously would have caused heavy killing back of the growth. An ideal climate for figs is one in which the minimum temperature is never lower than 16° F. and the maximum from 90° to 100° in the shade.

Nearby Markets.—The fig is at its best when allowed to ripen fully on the tree. In addition it does not keep long after being harvested. For this reason it is very important that a fig orchard be located near a good market. Figs should reach the consumer from 18 to 24 hours after they have been harvested. Some varieties, in favorable seasons, will hold up longer than this, but there is some danger of fermentation when they are on the road, even in refrigerator cars, for a longer time. However, the surest way to market figs in any quantity is in the preserved or canned state. Neither the climate nor the varieties grown in the Southeastern states are

adaptable to drying. But there is always a market for preserved or canned figs, and growers located near a cannery are sure of a market for their product. In some localities enterprising housewives have built up a trade in fancy preserved figs and the demand is greater than they can supply. The organization of the Girls' Canning Clubs has done much to popularize the canned and



FIG PRODUCTION IN THE UNITED STATES
Sections of California and the southern states.

preserved fig. It is very important that a market for both the fresh and the preserved product be planned before the grower plants a large acreage to figs.

Soil for Figs.—The soil for figs should be well drained but both moist and fertile. It is more than probable that the reason the fig thrives at the back door-step is because these conditions are present. A deep, fertile soil, containing a considerable percentage of clay is probably best for figs. A sandy loam with a clay subsoil is also satisfactory. Light, porous, sandy soils

should be avoided for (1) they fail to retain moisture; (2) they become very hot in summer, causing injury to the roots of the trees; and (3) they are the type of soils in which root-knot nematode develops on the roots of the trees. The nematode does much less damage in clay soils than in sandy soils. The best soil for figs contains some lime as this fruit does not thrive on acid land, but if the soil is satisfactory in other respects the lime can be added.

Slope or Exposure of the Land.—The slope or exposure of the land is of no great importance. However, some growers located in the warmer sections of the South where spring frosts are common, prefer a northern slope or a location on the crest of a ridge or hill. On such exposures the growth of the trees will be retarded somewhat, owing to more uniform low temperatures.

Number of Figs to Plant.—No general suggestions in regard to the number of fig trees that it will be profitable to plant can be given. This is dependent upon the market. If the grower is contemplating preserving or canning the fruit he must take into consideration the supply of labor available for this kind of work. From one to five bushels of fruit can be expected from a single tree according to the variety and the season. Therefore, from six trees to half an acre in figs would be a safe venture until the grower has worked up a sufficient market for his product.

Job 2—Procuring the Trees

After the grower has decided to plant figs, his next problem is the variety to plant and where to procure the trees. In selecting a variety to plant the grower should

investigate those that thrive in his section. There are a few excellent varieties in many fig-growing communities that have been lost to the trade. Where these are known to do well they should be propagated and used.

Characteristics of a Good Variety.—Some of the good points to consider in choosing a variety of figs are as follows: (1) a variety that will resist cold, (2) one in which the fruit will not crack badly in rainy weather, (3) one that bears heavy crops of good quality fruit, and (4) for canning and preserving the fruit should be medium to large in size and rather firm when ripe.

No one variety has yet been found that possesses all these qualities. However, there are marked differences in varieties of figs and one fairly suitable to the purpose can be selected if proper care is taken.

Smyrna Figs.—The Smyrna fig, the dried fig of commerce, is not adapted to the Gulf states. It is grown successfully in California where it is being dried in commercial quantities. The flowers, borne, as in all figs, on the inside of the fruit, are all female or pistillate. They must be pollinated or caprificated, as it is called, by pollen from the Capri or wild fig, and there is only one insect, the wasp-like *Blastophaga*, that performs this work. If the flowers are not pollinated, the fruit shrivels and drops from the tree. For this reason the Smyrna is not adapted to regions in which this insect cannot survive the winter. Experimental work being conducted at the present time indicates that the fig insect will survive the winter along the Atlantic Coast of Georgia and South Carolina. One tree at Brunswick, Georgia, has maintained a colony of insects successfully since 1917.

In 1905 a number of Smyrna figs and also the Capri were planted at the Georgia Experiment Station. The *Blastophaga* was brought here also, in order to carry the

pollen from the Capri to the Smyrna figs. It was found, however, that the little wasp failed to survive the winters so the culture of this fig was discontinued in this section. However, near the Atlantic Coast line of Georgia, where the *Blastophaga* has been able to survive the winter, there are a few trees of the Smyrna type being grown.



YOUNG FIG ORCHARD WITH COWPEAS BETWEEN THE ROWS

The seed of the Smyrna fig will germinate readily. There are a number of these trees from the seed of the dried figs of commerce scattered throughout the South but they are worthless. The young figs, not being pollinated, soon shrivel and drop off.

The Common Fig.—The common or so-called "Mule" class of figs is adapted to the Gulf states. It is grown in France, Portugal, Spain, Greece, and other countries of the Mediterranean Sea as well as in California and the Gulf states of this country. In this class of figs the fruit develops *without the pollination of the flowers*. However, the seed are mere empty shells and are not capable of germinating, unless they are pollinated.

Varieties for Southeastern States.—For the states east of Texas, the Brown Turkey, Celeste, Green Ischia, Brunswick, and San Pedro are possibly the best adapted. The Brown Turkey and Celeste are the hardiest of all the figs. Of these it is said that the Brown Turkey does best under field conditions. The Green Ischia is somewhat less hardy than the first two, and the Brunswick is best adapted to the Gulf Coast section of Texas. The San Pedro does well in Florida where it is especially prized for table use. It thrives only in sections with warm early springs. The Magnolia variety is used almost exclusively in the commercial fig orchards in the Gulf Coast region of Texas. However, this variety is not very hardy to cold and the fruit cracks rather severely when grown in the Southeastern states.

Description of Varieties

Celeste.—This variety, commonly known as Celestial or "Sugar Fig," is found in the dooryards of more southern homes, probably, than any other one variety. The tree is vigorous, grows large, and is very hardy to cold. The tree is very prolific and ripens its fruit in July and August. The fruit is pear-shaped, medium to small in size, the skin purplish brown in color, the pulp pinkish red when ripe and of excellent quality. The fruit of the Celeste cracks very little in wet weather and is very popular. This variety is strongly recommended for home use.

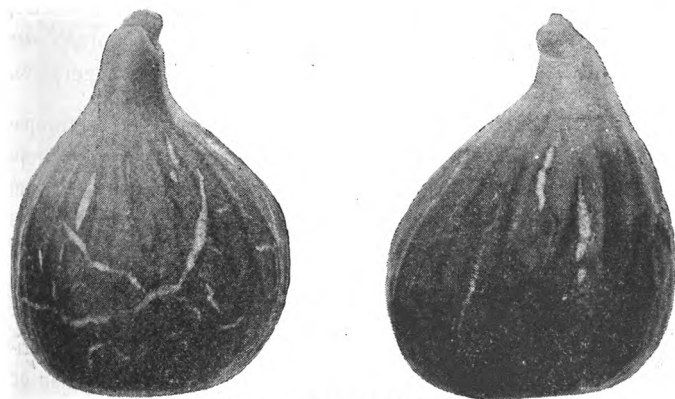
Brown Turkey.—This variety, like the Celeste, is very resistant to cold. The tree is a strong grower though not quite as vigorous as that of Celeste. The fruit is medium to large, with a reddish brown skin tinged with purple. The pulp is reddish pink and of good quality. The Brown Turkey is a good shipper for a fig and is used extensively in the Southeastern states for marketing purposes. This variety is preferred above all others for preserving.

Green or White Ischia.—The tree of the White Ischia is strong and fairly vigorous. Its fruit is medium in size, green on the outside, with red meat when ripe. The fruit begins ripening from the middle to the latter part of August and has few equals in quality.

Brunswick.—The tree of the Brunswick is somewhat small and of straggling growth. It is less hardy to cold than either the Celeste or the Brown Turkey. However, it stands the climate well in the Gulf Coast region of Texas where it is used almost exclusively in commercial plantings.

San Pedro, White (Brebis).—This fig is also called Brebas from the fact that it matures only its first crop or brebas without caprification. It is very large, round, flattened at the apex, stalk and neck short, eye open, skin thick, tender, of a bright yellow color or greenish in the shade, and pulp amber. A remarkable and handsome fig. Suited only for table use.

Lemon.—The quality of this fig is poor but it is large and has been used for canning and preserving for generations in Georgia. A tall, vigorous, though straggling grower, with medium to large golden yellow fruit. It sours readily. It is ex-



TWO TYPES OF FIGS

Left, Brown Turkey; right, Celeste.

cessively productive and it is possible that this is the reason it has been planted so widely.

Where to Obtain Fig Trees.—It is best to get cuttings from trees of the varieties preferred and grow the young trees in a nursery at home. In this way the nursery stock can be guarded against nematodes and other insects and diseases.

Cuttings made in the late fall will not be ready to set in the fields until the following late fall or the next early spring. For this reason the grower must plan to start his cuttings practically a year before he is ready to set them in the field.

If it becomes necessary to buy the trees, they should be purchased from the nearest reliable nurseryman who has a good grade of trees for sale at a reasonable price. If convenient, the nursery should be visited for the purpose of inspecting the trees before buying.

Grade of Trees to Buy.—Fig trees from two to five feet high may be grown from cuttings the first season. Therefore, one-year-old trees, which are well rooted, stocky, and about three feet high, are the correct size for planting and will grow off as well as the larger trees.

Propagating the Fig.—The best method of propagating the fig is by cuttings. However, it can be propagated by layering, by grafting, by budding, and from seed. Rooting plants from layers, which also includes the rooted suckers or sprouts from the crown or base of the older tree, is generally practiced where only a few plants are desired. Propagating figs by grafting or budding and from seed is of interest only to the experimenter and is seldom practiced by the nurseryman or the practical fig grower. The most practical method of rooting figs in large quantities is by cuttings.

Making Fig Cuttings.—Cuttings should be made in late fall or winter. In those sections where the cold is sufficient to freeze the twigs the cuttings should be made in late fall before there is danger of severe freezing weather. Select well-matured wood of the past season's



TYPES OF FIG CUTTINGS

They are made in fall, bound with wire, labeled, held in moist sand through the winter and planted to the nursery in early March.

growth from one-quarter to three-quarters of an inch in diameter. Two-year-old wood may be used but the wood of soft immature fig sprouts or suckers is not fit for this



CUTTINGS

Left to right: two cuttings of figs, two cuttings bunch grapes, fifth a heel grape cutting, sixth a mallet grape cutting, and seventh and eighth Carolina Poplar cuttings.

purpose. The cuttings should be from 10 to 12 inches long and should contain two or more joints or nodes. A number of cuttings may be made from one twig or limb. The end cutting, containing the terminal bud, is most desired by some propagators, but it has been found that cuttings made further down the limb will root equally as well.

Cut Just Below the Joint.—Cuttings put out roots from the nodes or joints. In making these cuttings the cut should be made just below the joint and square across at the lower or basal end. If the twig is cut at some distance from the joint it will die back to the joint and the chances of the cutting setting root will be reduced. The upper end should be cut with a slope and should extend about one-half inch above the node or joint.

When to Set Out the Cuttings.—The cuttings may be set in the nursery as soon as made or they may be tied in bundles, properly labelled, and buried in moist sand or moss until early spring and then set out. In the lower South, where the winters are very mild, it is advisable to set the cuttings in the nursery as they are cut. In the more northern part of the territory adapted to figs there is some advantage in early spring planting. Even in this territory, however, the fall or early winter plantings may be protected by a mulch of straw spread over the nursery.

Soil for the Nursery.—A piece of ground which holds moisture well and yet is well drained should be selected for rooting fig cuttings. If feasible, some provisions should be made to irrigate or water the nursery during dry weather in late spring or early summer. A soil with sufficient humus and sand to prevent severe

crusting is desirable. However, the most important point to observe in selecting the soil for the nursery is that it should be free from nematodes. If the soil is not fertile it should be made so.

Setting the Cuttings.—The land for the nursery should be well broken and harrowed and laid off into deep, narrow furrows four feet apart. The cuttings are placed by hand, ten inches apart, in the furrows. They should be set deeply so that the soil is even with the top bud. The soil should be pressed firmly around the lower end of the cuttings and when the planting is finished the furrows should be almost level.

Care of the Nursery.—The cuttings will start growth with the warm weather in the spring. At this time they should be handled very carefully. The land should be kept free of weeds and grass, and the surface of the soil well stirred to conserve moisture. The greatest precautions should be taken not to strike the cuttings with the cultivating implements, for the slightest blow at this time may injure the tender roots which are starting growth from the nodes of the cuttings.

Propagating the Fig by Layering.—There are two methods of propagating the fig by layering. The method in most common use consists of bending the sprouts or suckers which have come up from the roots of the fig tree and covering them with soil. This should be done during the months of June and July. A narrow trench is dug five or six inches deep near the sprouts. The sprout is then bent over and held in the trench by means of stakes or pegs. About ten or twelve inches of the terminal end of the sprout is left out of the trench. The soil is then packed firmly into the trench, covering the sprout so deeply that it will remain in contact with the

moist soil. The leaves are stripped off that part of the twig which is buried but left on the terminal end that remains out of the ground.

Roots will put out from the joints under the soil in late summer. The following winter these sprouts may be cut off at the base and taken up with fairly good roots and transplanted to the orchard.

In the second method of propagating the fig by layering, the sprouts are allowed to remain in their normal position. The soil is then banked around them to the height of ten or twelve inches. Roots will put out from the joints under the soil. During the following winter or early spring these sprouts are cut below the roots and transplanted to the orchard. These sprouts usually start from the crowns of the trees or from large roots near the surface of the soil and have practically no roots of their own. Banking the soil around them assists in root formation.

Budding and Grafting Figs.—For propagating the fig, grafting or budding is of no advantage. Trees from cuttings will bear fruit the second year and this is as early as they can be expected to bear from grafting or from budding. However, grafting is often used for top-working large fig trees. Any of the methods of grafting recommended for pecans may be used with the fig, but the cleft graft method is preferable. The work should be done during the dormant season.

Budding the fig is extremely difficult since the flow of the milk or sap interferes with the work of budding which must be done during the spring or summer.

Growing Figs from Seed.—Growing figs from seed should be left to the experimenters. Seed from the dried Smyrna figs found on the market will germinate but the majority of the trees from these seed are practi-

cally worthless. Seed from common figs are ordinarily but empty shells and will germinate only when pollinated.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Why would you recommend fig growing as a side line rather than as a chief money crop?
2. What three points must be considered in fig growing?
3. Where are figs grown?
4. Under what conditions must figs be planted north of the fall line?
5. What are ideal climatic conditions for figs?
6. What two ways can figs be marketed?
7. Why is the marketing of figs such a problem?
8. What kind of soil is suitable for figs?
9. What kind of soil should be avoided and why?
10. Why do some growers located in the warmer sections of the South prefer a northern slope or top of a ridge?
11. Why is it safe to plant only a few fig trees as a beginning?
12. Before deciding upon a variety of fig to plant in a section what investigations should be made?
13. What are the characteristics of a good variety?
14. What varieties do best in your own neighborhood?
15. Why are Smyrna figs not adapted to the Southeastern states?
16. What class is adapted to this region?
17. What peculiarity has it?
18. Discuss the varieties that are recommended for the Southeastern states.
19. What is the best method of securing trees of the desired variety?
20. What size trees are best to set out?
21. What other methods besides cuttings can be used in propagating the fig?

22. When should cuttings be made?
23. Bring to class some fig cuttings that you have made according to directions given in the text.
24. When should the cuttings be set in the nursery?
25. What kind of soil is best for a fig nursery?
26. What points should be observed in setting the cuttings?
27. What care should be given the nursery?
28. By what two methods can the fig be propagated by layering?
29. Is there any advantage in grafting figs?

SUGGESTED EXERCISES

1. Make a survey of the fig trees in your community and make a record of those which are doing well and those which are not. If the trees are not doing well make a careful study of the surroundings, including soil, culture, exposure, insects or diseases attacking the trees, and the winter temperatures for the region, in an effort to locate the difficulties with the crop.
2. If any very old fig trees are thriving and producing in the community, compare their surroundings, soil, culture, etc., with trees or orchards not doing well and see if the cause of the difference can be explained.
3. Visit the nearest nursery propagating figs and study the methods used in growing and selling fig nursery trees.
4. At your home practice the methods of propagating figs that are discussed in the text.

CHAPTER XXVIII

FIGS—GROWING AND MARKETING

Job 3—Setting Fig Trees

After the grower has selected the land and made arrangements for procuring the trees, his next problem is setting them in the orchard. This involves a thorough preparation of the land before the trees are set and heading back the young trees after planting.

Time for Setting the Trees.—In most sections of the South fig trees may be set from November to March. For the lower South December is preferred. In sections of the upper South where heavy freezes during the winter are common, the nursery fig trees may be given winter protection by heeling in deeply or by covering with straw and then setting in the orchard in the early spring before growth begins.

Preparing the Land.—Unless the soil is already very fertile, a broadcast application of stable manure at the rate of about 12 tons to the acre should be given just before the land is broken. Then the land should be plowed to the depth of eight or nine inches. Following this, about 2 tons of ground limestone or about 1,500 pounds of air-slaked lime to the acre should be put on the land, after which the surface of the soil should be harrowed.

The rows should be laid off by the same plan used in laying off a peach orchard. In the upper South the rows may be spaced $17\frac{1}{2}$ feet apart and the trees planted only 10 feet apart in the row. In this section the fig is

often killed back more or less during the winter so that the shrub or bush form of training is practiced. Here the fig tree seldom reaches a large size and consequently needs less distance.

In the lower South there is a strip of territory along the coast and in Florida, where the trees are seldom killed to the ground and consequently reach a much larger size. In this section, trees require more space. Rows 20 feet apart and the trees set 15 feet apart in the row have been found satisfactory for the coast region. However, the California growers recommend that the trees be set 40 feet apart each way.

How to Set Fig Trees.—Young fig trees must be handled with the greatest care when taken from the nursery. The roots will stand very little exposure to the drying effects of wind and sunshine. For this reason some growers carry them from the nursery to the orchard in barrels of water.

Holes are dug large enough to allow the roots to spread normally when the young tree is set. Broken and injured roots should be trimmed with a sharp pair of shears and the trees set about three inches lower than they stood in the nursery row.

Only mellow, moist topsoil free of trash is used in filling the holes when the tree is set. Care should be taken to pack the soil well around the roots. If the soil is dry, two or three gallons of water should be poured into the hole after it has been half filled with soil. When the hole is filled, the soil should be left loose on the surface for the purpose of conserving the moisture.

Heading Back the Young Tree.—The height at which the tree should be cut off after it is set will depend upon the system of pruning that is to be followed in the orchard. If the trees are to be grown to a single

trunk, as peach trees are grown, the trees should be headed back to a height of about 18 inches. On the other hand, if the bush or shrub method is to be followed in which 6 to 12 main stems are allowed to grow, the young trees should be cut back to a height of only about 6 inches to induce the sprouting near the ground. In fact, where the bush method is practiced some growers set the young trees some five or six inches deeper than they stood in the nursery and then cut them off even with the surface of the soil. This practice induces a number of sprouts to put out from beneath the surface of the soil and so forms a crown of young trees quicker than if the young tree had been headed back some distance above the ground. Occasionally a grower will follow the practice of planting two young trees together in order to get a number of sprouts quickly.

Job 4—Cultivating the Orchard

The chief task in cultivating the orchard is keeping down the weeds and grass. Fig roots grow so near the surface of the soil that deep plowing is very harmful. The injury of deep tillage is especially harmful if the plowing is done in summer or during the growing season after the trees become large. Where fig trees are planted in orchard form it is too expensive to keep down the weeds and grass with a hoe so that some kind of tillage with mule and plow becomes necessary.

The practice usually followed in the fig orchard is to break the soil between the rows of trees during the winter or early spring before tree growth begins. At this time the land is turned only three or four inches deep with a disk harrow or turn plow. As spring opens, weed growth is kept down by running through the orchard frequently with a drag or spike-tooth harrow or some other

implement which will destroy weeds and yet stir only the surface soil. Weeds and grass are removed from around the tree with a hoe.

Mulching the Soil Around Fig Trees.—While the fig requires a well-drained soil, it nevertheless must have an abundance of moisture for best results. This is thought to be a partial explanation of the fact that the fig thrives so well in the back yard of homes where often clothes are washed and where waste water is thrown out at regular intervals. Shading the ground also tends to conserve the soil moisture and prevents high soil temperatures which are so injurious to shallow roots.

For this reason some growers have found it a good practice to mulch the soil around fig trees with compost, straw, leaves, or any other convenient material. This mulch should be spread over an area around the tree extending out some three or four feet beyond the spread of the top. It should be five or six inches deep or sufficiently deep to keep down weed growth on the covered area. In this way only the uncovered soil some distance from the tree will have to be cultivated. The practice of mulching tends to keep the soil both cool and moist.

Cover Crops for a Fig Orchard.—About September 1, a *winter* cover crop of vetch or crimson clover should be sown in the orchard. This crop should be turned under in late winter or early spring before it reaches sufficient size to require deep plowing to cover it.

The growing of a *summer* cover crop in a fig orchard is a doubtful practice. It is certainly unwise to grow those that are subject to the attacks of the root-knot nematode. Moreover, summer cover crops require and consume large quantities of soil moisture just at the time the fig trees need it most for developing and ripening their crop of fruit.

Job 5—Fertilizing the Orchard

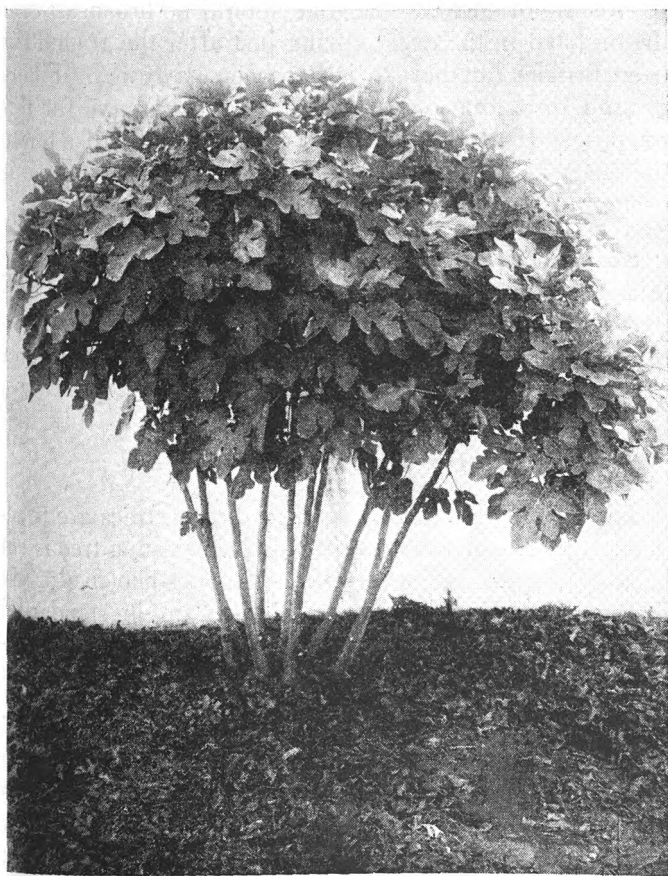
It cannot be emphasized too strongly that the fig requires a rich soil. Therefore it should be the policy of the grower to keep his soil rich throughout the entire life of the orchard. An acre of fig trees in full bearing and not injured by cold should produce about 10,000 pounds of fruit in one season. This amount of fruit removes from the soil about 40 pounds of potash, 10 pounds of phosphoric acid, and 23 pounds of nitrogen. In addition to this, there are the plant food constituents removed by the prunings which are usually hauled away and burned, and by the leaves which are blown off the land by the wind. From this it can be seen how necessary it is to add plant food to the soil each year to take the place of some of that removed.

When to Fertilize.—The first spring after the orchard is set, just before the first cultivation, the young trees should receive from two to three pounds of fertilizer to a tree. This should be applied in a circle some 10 or 12 inches from the tree and extend out three or four feet, and should be worked into the soil with any convenient implement.

In the spring following, the fertilizer may be applied broadcast over the soil at the rate of from 400 to 600 pounds to the acre.

Fertilizer Mixture for Figs.—For the sandy loam soils of the Coastal Plain, a fertilizer mixture analyzing about 5 percent nitrogen, 8 percent phosphoric acid, and 5 percent potash should be used. But for the clay loam soils of the Piedmont section which are rather rich in potash, a mixture analyzing about 4 percent nitrogen, 8 percent phosphoric acid, and 3 percent potash should be satisfactory.

Summer Fertilizer.—If the trees show a lack of thrift in midsummer, which is indicated by the leaves becoming pale green rather than a dark green color, their condition will be improved by being given an application of some quickly available fertilizer high in



FIGS PRUNED TO THE CLUSTER FORM THE SECOND SUMMER AFTER PLANTING

nitrogen. About 75 pounds of sulphate of ammonia or 100 pounds of nitrate of soda to the acre will serve this purpose.

Lime.—Unless the soil is known to be rich in lime it should be limed every third or fourth year during the life of the orchard. The lime should be broadcast over the orchard in the early spring just after the ground has been broken but before it has been harrowed. Finely ground limestone or air-slaked lime will serve for this purpose. If air-slaked lime is used, about half a ton to the acre should be sufficient; but if ground limestone is used, two tons per acre is not too much.

Stable Manure.—Where available, about twelve tons of stable manure should be applied to the land during the winter about every third or fourth year. However, this may be omitted after a few years if the winter cover crops are planted as suggested under Cover Crops.

Job 6—Pruning the Orchard

Three general methods of pruning fig trees are practiced: (1) the bush form, in which the young tree is cut back to the ground when planted and some five or six shoots allowed to grow; (2) the "single standard," where only a main stem is allowed; and (3) a semi-renewal system, in which practically all the last season's growth is removed during the dormant season.

Advantages of the Bush System.—Pruning to the bush form offers the following advantages: (1) the trees can be more easily protected against cold; (2) they come into bearing earlier should they be frozen back; and (3) the trees bear more fruit during their early productive period, and the fruit is more easily harvested.

This method of pruning is followed most in the upper South where severe cold injury to figs is common.

When the trees reach the bearing age and their shape is established, about all the pruning necessary is to keep



THE CELESTE FIG PRUNED TO A SINGLE STEM THE SECOND SUMMER
AFTER PLANTING

the suckers cut out and an occasional limb removed from the center to prevent crowding. It is a good practice to keep the suckers pinched out as they sprout during the summer. Of course all dead wood should be removed. This often becomes a laborious job after a severe winter freeze which may kill all the preceding season's growth. Sometimes the tree is killed back to the ground.

Pruning to a Single Stem.—Pruning to a single trunk or stem is practiced mainly along the coast and in the lower South where the trees are seldom killed to the ground by cold weather. In following this method of pruning, the trees are headed back to a height of about 18 inches. Four or five lateral shoots are allowed to grow out which form the main framework or head of the tree. Following this the tree is kept in shape by removing the suckers from its base. No effort is made to keep the head of the tree open to admit sunshine as the large spreading leaves of the fig completely shade the tree by almost any method of pruning. When the tree is once well shaped very little pruning will be needed thereafter.

Semi-Renewal System of Pruning.—In pruning by the semi-renewal system, the trees are pruned to a single stem or trunk and the top severely cut back each dormant season. This method is practiced mainly in Texas with the Magnolia variety. Practically all the preceding year's growth is removed, leaving the limbs very much shortened. This practice is followed year after year, cutting back the annual growth about one-half to three-fourths its length as the trees become older. Some of the growers are convinced that this method of pruning gives them fruit of a better grade than when very little pruning is done.

Care of the Cut Limbs.—In cutting out limbs by any method of pruning, care should be taken to make the cut just above a lateral limb so as to prevent bare stubs which later die back to a lateral branch or crotch.

Pruning Implements.—The implements for pruning fig trees are the same as those used in pruning other fruit trees.

Job 7—Combating the Diseases and Insect Pests of the Fig

Very little work has been done by the experiment stations on controlling diseases and insect pests of the fig. Consequently, little is known about them. The soft-rot of the fruit and the rust of the foliage are probably the most widespread of the diseases and the three-lined fig tree borer is the most important of the insects that attack the fig. However, the nematode, which can hardly be classed as either insect or disease, is the worst malady of the fig and is one of the difficulties encountered in fig growing.

Soft-Rot.—The fungus which produces soft-rot is the black mold that develops so frequently on moist bread. It is much more serious in damp weather. No remedy can be suggested except that figs should not be harvested while wet or allowed to stand in deep receptacles where drying out is impossible. The Celeste, of all the varieties, is the least susceptible to this disease.

Rust.—Rust is a disease of the leaves. The affected leaves first show some light-colored postules or pimples on the under side. These postules increase until the leaves begin to die and in a short time fall off. To control this some growers spray with bordeaux mixture three or four times during the growing season. To make

the mixture, 4 pounds of bluestone and 5 pounds of lime to 50 gallons of water are used. Some growers use eight to ten pounds of lime instead of the quantity mentioned. Methods of mixing these ingredients are given in the chapter on grape insects and diseases.

Three-Lined Fig Tree Borer.—The mature beetle is a gray-brown insect with three scalloped white stripes, one on each side and one in the center of the back, extending almost the full length of the insect. The antennae are more than twice as long as the body. The larva or worm is white or nearly so, and is about two inches long when full-grown. It bores into the wood, often going to the very heart of the branch or trunk. The beetle lays its eggs around limb crotches or gains entrance through injuries to the bark. The only remedy known is to dig out the borers with a strong knife or some other serviceable implement. All tree wounds should be cleaned and painted with tar or some other covering. This pest is not serious when the tree is strong and vigorous.

Common Green June Bug.—The common green June bug or fig-eater, as it is also called, is sometimes a pest in a fig orchard. They eat the ripe fruit, making it unfit to use. Gathering the beetles by hand is the only useful method of controlling this pest. A boy with a bucket of water, in which there is sufficient kerosene to form a thin film, picks off the beetles and puts them into the bucket. Sometimes the trees are jarred and the beetles picked from the ground. During the height of the beetle season "picking beetles" is a rather arduous task as other beetles soon take the place of those removed.

Nematodes.—The fig, of all the orchard fruits, is the most susceptible to the nematode. This malady is

worse in some soils than in others, and for this reason care must be taken in selecting the soil for the fig. Young trees bought from a nursery should be examined

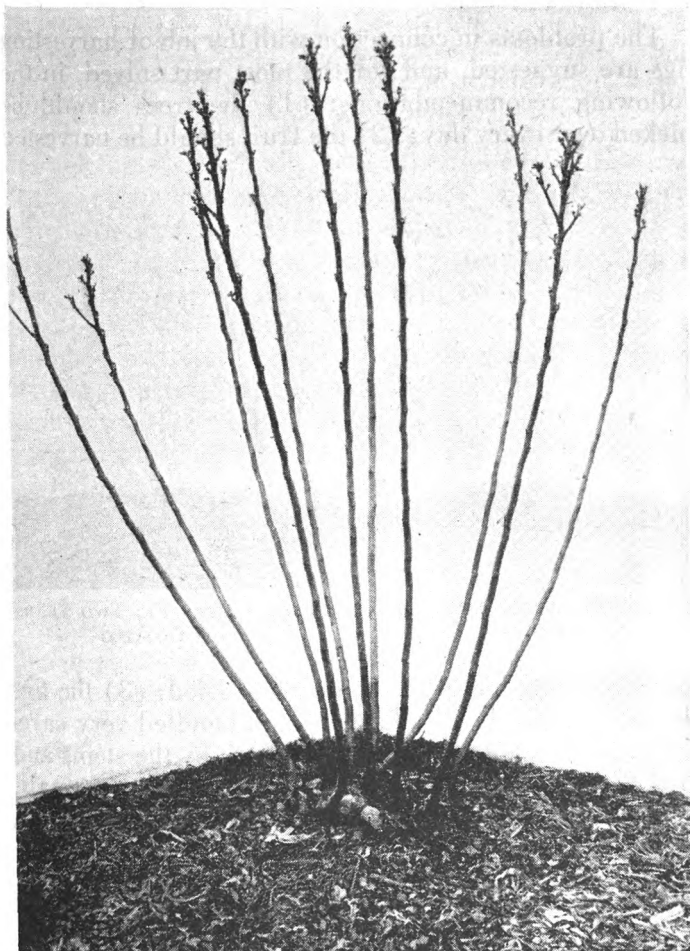
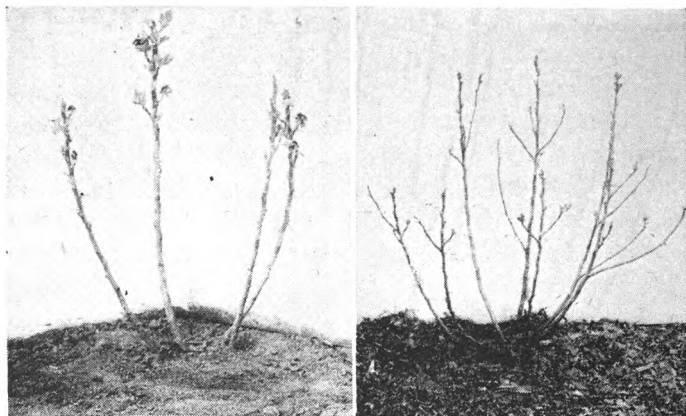


FIG ONE YEAR FROM STUMP

carefully and rejected if knots or swellings are found on the roots.

Job 8—Harvesting Figs

The problems in connection with the job of harvesting figs are suggested, and for the most part solved, in the following recommendations: (1) the trees should be picked over every day; (2) the fruit should be harvested



YOUNG FIG ONE YEAR FROM PLANTING BROWN TURKEY FIG TWO YEARS FROM CUTTING

in the morning but after the dew has dried; (3) the figs should be picked with the stems and handled very carefully; (4) some pickers catch the fruit by the stems and give a quick, upward jerk, while others use a small, sharp knife; (5) the fruit should never be poured from one receptacle to another; and (6) as the fruit is picked it should be placed gently in shallow strawberry trays and not handled again until packed. Most pickers use cotton gloves to protect their hands and arms from the juice of the fruit and the nettles of the leaves.

Stage of Ripeness of the Fruit.—For home use and the local market the fruit should be fully ripe when it is picked from the tree. It is then at its best and is a really delicious product. For shipping or for canning or preserving it should be ripe but firm. It is impossible to ship soft figs. However, figs that are too green never ripen, and consequently are tasteless and often bitter when they reach the consumer.

Packing.—The fruit should be graded for size and degree of ripeness and then packed in 24- or 32-quart strawberry crates. It requires 22 large figs to fill a quart. Nine of the figs should be placed on the bottom of a quart basket with stems pointing up. The next layer consists of four figs with stems pointing down; these fit into the four large spaces around the central fig on the bottom. The top layer consists of nine figs with stems pointing downward. With the smaller fruits no systematic method of packing can be followed. The fruit is put in the quart baskets like strawberries. It is very important that each fig be perfect. Those that are soft, broken, or show signs of decay should be left out of the package if it is to be shipped.

Marketing.—Figs may be marketed under refrigeration through the same channels as other perishable fruit. Very few sections of the South produce enough figs for the market to have a cooperative marketing association for this particular crop. However, the crop can be sold through some association handling other crops, or may be sold on consignment. The fig has such little competition in the markets of the large cities that it should not be difficult for the grower to deal directly with the consumers. Railroad dining cars, chain grocery stores, and large hotels are usually good customers for fresh figs of good quality.

Canning plants afford good markets for figs in quantity. Even though the cannery may not pay as much as consumers of fresh figs, the grower can deliver his crop to the cannery with much less trouble and risk, and can afford to take a much lower price.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. What is the best time for setting fig trees?
2. Give the steps necessary for a thorough preparation of the land.
3. How should the trees be handled when taken from the nursery?
4. What points should be observed in setting the young trees?
5. What two methods of heading back the trees are used?
6. What are the chief points to be observed in cultivating a fig orchard? Why is deep tillage injurious to a fig tree?
7. Give the steps in cultivating the orchard.
8. Why is a mulch beneficial to fig trees?
9. What are the advantages of a winter cover crop for figs? What are the disadvantages of a summer cover crop for figs?
10. What should be the policy of the fig grower in regard to the soil of his orchard?
11. What amount of plant food is removed from the soil for every pound of figs produced?
12. When should fertilizer be applied? How much should be given the young trees? How much as the orchard becomes older?
13. What fertilizer mixture is recommended for the Coastal Plain section? For the Piedmont section?
14. What summer fertilizer should be applied?
15. How much lime should be put on the soil and how often should it be applied?

16. What applications of stable manure should be made?
17. What are the three general methods of pruning figs? What method is practiced in your neighborhood?
18. What are the advantages of the bush system?
19. Where is the single stem system used? Give the necessary steps in this method of pruning.
20. Where is the semi-renewal system used? Give the steps in this method of pruning.
21. What care should be taken of the cut limbs?
22. What are the principal diseases of the fig? Insect pests? Describe each and give the remedy.
23. Describe the nematode and its effects on the roots of plants.
24. What precautions are necessary to prevent nematodes from gaining a foothold in the soil?
25. What points should be observed in harvesting the fruit?
26. How should figs be packed?
27. What are some of the difficulties in marketing figs on a commercial scale?

SUGGESTED EXERCISES

1. Visit nearby fig orchards and study the methods of fertilizing, cultivating, and pruning the trees. Study also the methods of harvesting, packing, and marketing the crop. Compare the profits from the fig orchard with other fruit crops of the community.
2. If there is a fig cannery in the community, visit it with the class and study the methods of canning figs on a commercial scale.

SEASONAL WORK IN THE FIG ORCHARD

September, October, and November

1. Harvest and utilize the late crop of fruit as it ripens.
2. Sow a winter cover crop in September or October.
3. Make cuttings of figs after leaves shed and before freezing weather comes. Store or plant these cuttings so they will not be injured by cold during the winter.

December, January, and February

1. Cuttings may still be made for propagation during December if cold has not already injured the twigs.
2. Apply stable manure between the rows of trees in January and February. Apply lime to the soil also if the orchard has been without lime for three years.
3. Put fig cuttings out in the nursery and set young fig trees out in the orchard after the crest of winter has passed.

March, April, and May

1. Complete setting out young fig trees and putting out cuttings if the job was not completed in February.
2. Prune the trees in early March or as soon as danger of winter freezes has passed.
3. Cultivate the soil of the orchard and turn under the winter cover crop or stable manure which was applied during the winter. Fertilize and cultivate to keep down weed growth.
4. Spray the trees with bordeaux mixture after the leaves come out if any signs of rust are observed.

June, July, and August

1. Continue to cultivate to keep down weeds.
2. Plant a row of legumes between the rows of trees in late summer.
3. Harvest and dispose of the fruit as it ripens.

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CHAPTER XXIX

THE HOME ORCHARD

Job 1—Selecting the Land for the Home Orchard

The planting of a home orchard should appeal to those having only space in the back yard on a city lot as well as to owners of large farms. In selecting the land it is well to observe the importance of soil drainage, air drainage, elevation, and soil fertility as outlined for the selection of a commercial peach orchard. It may become necessary to sacrifice some of these advantages in order to have the orchard near the home.

Soil for the Home Orchard.—So many fruits are grown in the home orchard that no one soil type can be selected best suited to all of them. A fertile sandy loam or sandy clay loam soil with a clay subsoil will be found suitable to most orchard fruits. It is so important to have the orchard located near the house that it is often advisable to drain, fertilize, and otherwise improve an area for the home orchard which would not be profitable for establishing a commercial orchard.

Size of Home Orchard to Plant.—The size of the home orchard should be determined by (1) the amount of land available, (2) the labor supply for taking care of it, and (3) whether there is a ready market for any surplus fruit above the needs of the family.

Families living in cities and towns where all orchard and garden plantings have to be confined to a single lot necessarily have to plant only a few trees here and there where the space can be provided. Where there is an

abundance of land, however, which can be used for the home orchard, the expense of planting and maintaining the orchard is the chief item to be considered. It is better to have a small home orchard well cared for than a large one neglected.

One Acre for the Farm Home Orchard.—A very good plan is to set aside one acre of good land for growing the principle fruits which are adapted to orchard cultivation. In addition to this, such fruits as figs and pomegranates may be grouped near the buildings where they will receive protection from the cold; and large growing trees, like pecans, may be planted about the premises to serve as ornamental trees as well as for fruit production.

Job 2—Procuring Trees for the Home Orchard

Home owners are frequently visited by tree peddlers or agents who make a house-to-house canvas. Unfortunately for the grower, these agents often lack the correct information as to the kinds of fruits and varieties best suited for the home orchard in a particular region. It is best not to buy trees until definite plans for the orchard have been made. When in doubt about what fruits and varieties to grow, write the experiment station or agricultural college for advice.

Some reliable nurserymen make a practice of propagating home orchard collections of fruits and will render good service when called upon. It is better to patronize the nearest nursery which sells good trees at reasonable prices. It is often convenient to get cuttings of grapes, figs, etc., from good varieties being grown by a neighbor, and root them at home.

Size of Nursery Trees to Buy for the Home Orchard.—A mistake very commonly made by home own-

ers is to select over-sized or large nursery trees for the home orchard. The idea seems prevalent that large trees will bear large crops of fruit much earlier than small trees. Experience has shown that the younger nursery trees bear practically as early, are easier to make live, and develop into more healthy, vigorous trees than do the over-sized nursery stock.

Large trees require a longer time to overcome the shock of transplanting, and if allowed to stay in the nursery until they are almost old enough to bear, as is the case with two-year-old nursery peach trees, it is doubtful if they ever fully recover from the shock.

Apple and pear trees grafted during the winter are ready to set the following fall.

Peach trees budded in June are large enough to set the following December.

Plums budded in midsummer are ready to set one year from the following December.

Bunch grape and fig cuttings put out during the winter or early spring will produce plants ready to set the following fall. Muscadine grapes are rooted as layers one summer and grown in the nursery the next summer, before they are ready to be set to the vineyard.

Pecans require two summers' growth after they are budded or grafted to become large enough for satisfactory orchard plantings; but where the nursery soil is fertile and the seasons favorable, they will sometimes become large enough to plant in one summer.

With the exception of pecans and muscadine grapes, one-year nursery stock is preferable to two-year stock. Two-year trees cost the nurseryman more to grow and are sold for more, but are usually worth less.

How to Arrange the Plantings.—Where the soil is somewhat rolling and varies in type, care should be

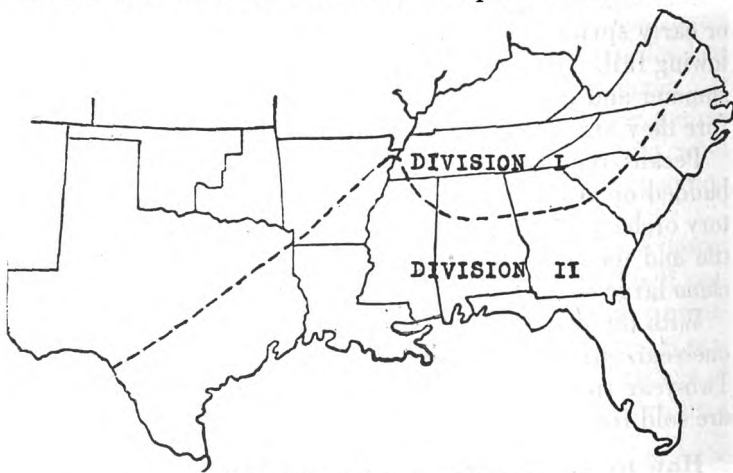
taken to locate each kind of fruit where it will grow best. Peaches and plums should be located on the more elevated portions of the orchard, while the apples should occupy the lower areas where the soils are usually stiffer. The muscadine grapes bloom late and are not likely to be caught by spring frosts, which enables them to thrive well on the lower areas of the orchard.

All trees should have plenty of space in which to develop and should be planted in evenly spaced rows to facilitate cultivating the orchard.

What Fruits to Grow in the Home Orchard.—

Only the fruits which are well adapted to the region should be grown in the home orchard. It is almost as useless to attempt to grow apples in the tropics as it is to grow oranges in regions where heavy freezes occur.

Fruits and Varieties for the Different Divisions of the South.—For convenience in recommending fruits and varieties which are adapted to the different



MAP OF THE SOUTHERN STATES
Showing Divisions I and II as referred to in the context.

regions, the South is separated into two general divisions. Many subdivisions could be made to advantage; however, the two will serve to make a general division of the fruits adapted to southern conditions.

VARIETIES FOR DIVISION I

Apples: Early Harvest, Red June, Red Astrachan, Horse, Rome Beauty, Delicious, Kinard, Stayman Winesap, Black Winesap, Yates, and Terry. Of these the Red Astrachan, Horse, Yates, and Terry are best adapted to the southern part of this division.

Cherries: Early Richmond and Montmorency. Planting cherries is advised only in the mountainous and colder parts of this division.

Figs: Celestial and Brown Turkey. Figs may be planted near the coast or near buildings where they can be protected against cold injury.

Grapes (White): Diamond, Elvira, Winchell, and Niagara.

(Red): Brighton, Catawba, Lucile, Delaware, and Ellen Scott.

(Black): Moores Early, Ives, and Concord.

(Muscadine): The varieties Scuppernong, Thomas, Hunt, Stuckey, Creek, Yuga, and Dulcet will grow near the coast and in the southern part of this division.

*Peaches**: Mayflower (w, c), Uneeda (w, c), Early Rose (w, c), Arp Beauty (y, c), Mikado (y, sf), Hiley (w, f), Belle (w, f), Elberta (y, f), Hale Haven (y, f), Chinese Cling (w, c), and Late Elberta (y, f).

Pears: Kieffer, LeConte, Garber, and Magnolia. A few trees of the Pineapple pear may be planted near the coast and in the warmer parts of this division.

Pecans: Stuart, Schley, Pabst, Success, Moneymaker, Moore, and Frotscher may be planted near the coast and in the southern part of the division. The Indiana and Niblack may be planted in the colder parts of the division.

Persimmons: Native persimmons may be planted in most

* w—white; c—cling; sf—semi-freestone; y—yellow; f—freestone.

sections of this division. The Tane-Nashi and Hyakume are varieties of the Japanese persimmon which may be planted near the coast and in the warmer parts.

Plums: Wild Goose, Abundance, Winesap, Shiro, Methley, and Damson.

Blackberries: Eldorado and Mesereau.

Dewberries: Lucretia and Youngberry.

Raspberries: Dixie and Sodus.

Strawberries: Blakemore, Klondyke, and Missionary.

DIVISION II

Apples: Only the northern fringe of this division is recommended for planting apples. Suitable varieties for this purpose are Early Harvest, Red Astrachan, Horse, Yates, Terry, Red Delicious, and Golden Delicious.

Cherries: Cherries are not adapted to this division.

Figs: Celestial, Brown Turkey, Lemon, White Ischia, Magnolia, and Brunswick.

Grapes (Bunch): Niagara and Caco.

(Muscadine): Hunt, Stuckey, Thomas, Scuppernong, Creek, Yuga, and Dulcet.

Peaches: The varieties of peaches recommended for Division I are well adapted to the northern half of this division. The following varieties are recommended for northern Florida and the southern coast region: Jewel (y, f), Honey (w, f), Imperial (w, f), Pallas (w, f), Waldo (w, f), Florida Gem (w, f), and Angel (w, f).

Pears: Pineapple, Kieffer, LeConte, Garber, and Magnolia.

Pecans: Stuart, Schley, Pabst, Success, Frotscher, Money-maker, Moore, Curtis, President, and Teche.

Persimmons: Tane-Nashi, Hyakume, Okane, and Hachiya. The native persimmons are well adapted to this division.

Plums: Methley and S.P.I. 47935.

Blackberries: Same as for Division I.

Dewberries: Lucretia and Youngberry.

Raspberries: Raspberries generally not adapted to this division. The Sodus variety is about the only possibility on the northern fringe.

Strawberries: Same as for Division I.

Local Varieties: It is a frequent occurrence that a variety of fruit will be found well adapted to a community but hardly known anywhere else. Such local varieties should be included in the home orchard collection where they have sufficient merit.

Diagram for a Home Orchard: The following is a suggested diagram for a one-acre home orchard. The varieties selected for this area are some of those adapted to middle Georgia and regions with similar soils and climatic conditions.

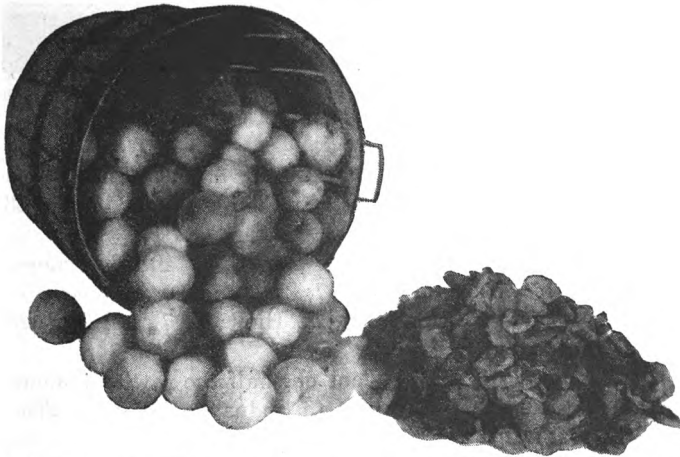
Pecans and figs are purposely omitted from this plan as the pecans may be planted as ornamental trees and the figs do best when grouped near the buildings.

LIST OF VARIETIES FOR ONE-ACRE ORCHARD

Apples: Row 1—Trees 1 and 2, Early Harvest; 3 and 4 Red Astrachan; 5 and 6, Horse; 7 and 8, Yates.

Row 2—Trees 1 and 2, Yates; 4, 5, and 6, Terry; 7 and 8, Red Delicious.

Pears: Row 3—Trees 1 and 2, Kieffer; 3 and 4, Pineapple; 5 and 6, Garber; 7 and 8, LeConte.

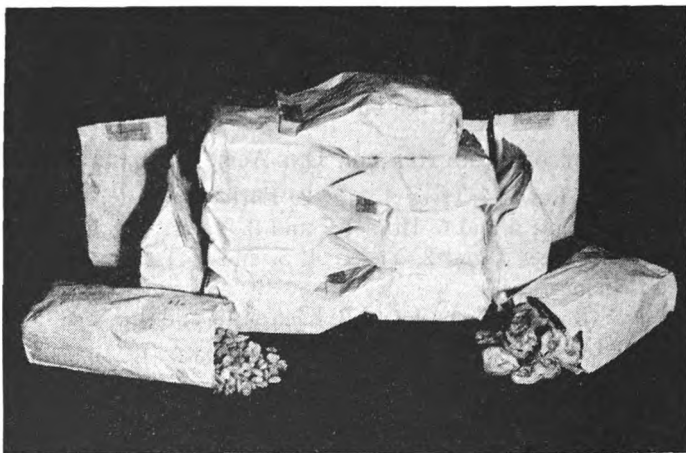


A BUSHEL OF PEACHES FRESH AND A BUSHEL OF PEACHES DEHYDRATED

Plums: Row 4—Trees 1, 2, 3, 4, 5, and 6, Methley; 7, 8, 9, 10, 11, and 12, S.P.I. 47935.

Peaches: Row 5—Trees 1 and 2, Mayflower; 3 and 4, Early Rose; 5 and 6, Mikado; 7, 8, and 9, Hiley; 10, 11, and 12, Belle.

Row 6—Trees 1, 2, 3, 4, 5, and 6, Elberta; 7 and 8, Chinese Cling; 9, 10, 11, and 12, Late Elberta.



CELLOPHANE LINED, MOISTURE PROOF, HEAT SEALING BAGS FOR DEHYDRATED OR FROZEN VEGETABLES AND SOME FRUITS

Bunch Grapes: Row 7—Vines 1, 2, 3, 4, 5, and 6, Concord; 7, 8, 9, 10, 11, and 12, Caco; 13, 14, 15, 16, 17, and 18, Delaware; 19, 20, 21, 22, and 23, Niagara.

Muscadine Grapes: Row 8—Vines 1, 2, and 3, Scuppernong; 4, male muscadine; 5, 6, 7, 8, 9, and 10, Thomas.

Row 9—Vines 1, 2, 3, 4, and 5, Hunt; 6, 7, and 8, Yuga; 9, male muscadine; 10, Yuga.

Blackberries: Row 10—Plant one-half the row to Eldorado blackberries and the other half to Sodus raspberries. Plants should be set 6 feet apart in the row and staked.

Dewberries: Row 11—Plant one-half the row to Lucretia dewberries and the other half to Youngberry dewberries.

Plants should be set four feet apart and supported by wire trellis.

Strawberries: Row 12—The row set to Blakemore straw-

Row	Feet	1	2	3	4	5	6	7	8
1	10	x	x	x	x	x	x	x	x
2	30								
3	30	x	x	x	x	x	x	x	x
4	24								
5	20	x	x	x	x	x	x	x	x
6	20	x	x	x	x	x	x	x	x
7	18	x	x	x	x	x	x	x	x
8	15	x	x	x	x	x	x	x	x
9	15	x	x	x	x	x	x	x	x
10	12	x	x	x	x	x	x	x	x
11	6								
12	4								
13	4								
	2								

LIST OF VARIETIES FOR ONE-ACRE ORCHARD

berries; plants set 16 inches apart.

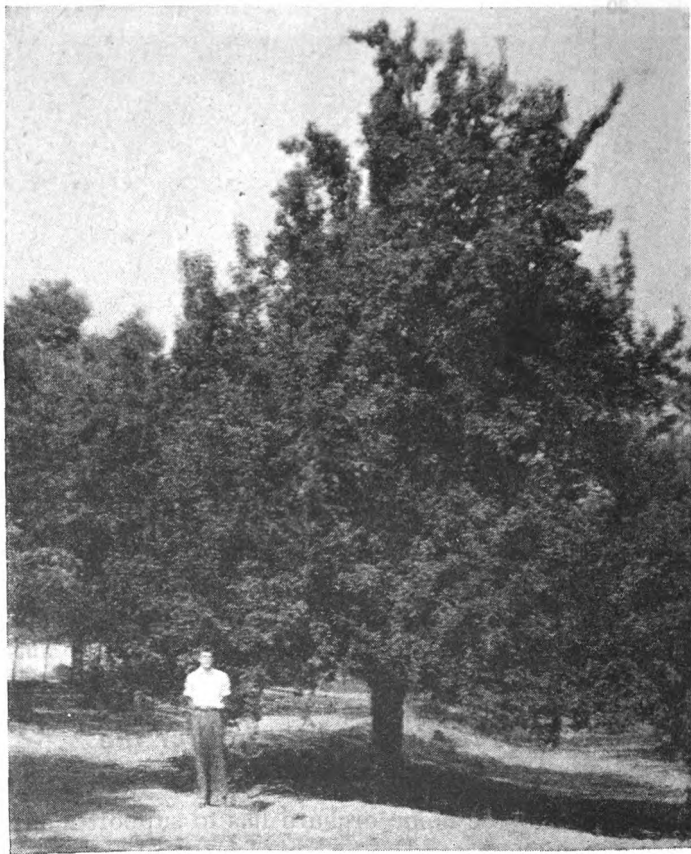
Row 13—The row set to Missionary strawberries; plants set 16 inches apart.

Job 3—Planting and Caring for the Home Orchard

The land for the home orchard has to support many kinds of fruit trees and is occupied by the trees for a long time. Thus it is highly important that the soil be thoroughly prepared before the trees are set.

Land for the home orchard should be prepared very much in the same way as for the home vegetable garden. It should be deeply broken and harrowed smoothly before setting the trees.

How to Lay Out the Rows.—Since the different



Courtesy of G. O. Starcher

SOME OF THE HYBRID PEARS ARE RESISTANT TO PEAR BLIGHT, ALSO
CALLED FIRE BLIGHT

fruits are differently spaced, all the rows for the orchard cannot be laid out the same distance apart as is practiced in commercial orchards. A plan of the orchard should be drawn and then the rows marked off according to the trees to be set. Where the home orchard contains no more than an acre, the rows may be laid out straight by means of a long cord stretched across the area. It is then simple enough to measure the distances apart the trees are to be set in the row.

Planting the Trees.—Having the land well broken and harrowed, it is necessary to dig holes only large enough to allow the roots of the young trees their natural spread. If the soil is reasonably moist, as it usually is during the late fall and winter, no water will be necessary in the holes as the trees are transplanted. Use fertile topsoil for filling the holes and see that it is worked in among the roots. The soil should be well packed around the young trees, but left loose on top.

Heading Back the Young Trees After They Are Planted.—In transplanting any tree the top should be cut back in proportion to the amount cut from the roots. Furthermore, orchard trees should be kept reasonably low to facilitate spraying, pruning, and the harvesting of fruit.

When the young orchard has been planted it should be gone over and the newly set trees pruned as described in previous chapters.

Fertilizers for the Home Orchard.—Where a supply of stable manure can be secured, the land for the home orchard should have a broadcast application of 25 to 30 tons to the acre. In addition to the stable manure a broadcast application of a high grade commercial fertilizer should be given. The fertilizer may be ap-

plied in the early spring after the trees are set. From 800 to 1,000 pounds to the acre is not too much to apply; for truck crops can be grown between the widely spaced rows and the land utilized until the trees become large enough to use all the space allowed them.

Cultivating the Home Orchard.—If the home orchard is expected to continue to bear good crops of fruit it must be kept well cultivated. Each group of fruits in the home orchard presents a separate problem in the matter of cultivation. The chief objects in each case are to keep down the weeds and grass and aid in holding insects and diseases in check by keeping the orchard clean.

Replanting Vacant Places in the Home Orchard.—When a tree dies in the home orchard it should be removed as promptly as possible. It is important to dig out all the roots that can be found and thoroughly dig up or spade the ground for a distance of three or four feet around where the tree stood. If the tree is removed during the summer, it is well to fill the hole with stable manure or compost, which will decay and enrich the spot by the time the young tree is to be set in the late fall.

Pruning the Home Orchard.—Directions have been given in previous chapters for pruning the principal fruits included in the home orchard. These directions may be followed in pruning the same fruits included in the home orchard. Pears are not pruned quite as much as apples because of the danger of fire-blight. The pruning of plum trees is quite similar to that of apples and with bearing trees consists mainly of thinning out the trees by removing some of the small branches. Trees which are growing too high should be headed back to outward growing branches. As the trees

become older, heavier pruning will be necessary. As a general rule young plum trees require very little pruning.

Time Required for the Orchard to Bear.—It is of interest to the planter of an orchard to know when to expect fruit from his trees. The age of a tree is counted from the time it is set in the orchard. The age at which trees bear after being set in the orchard varies; however, the following will serve as a general guide:

Apple, quince, and pear trees begin bearing from six to eight years after they are set in the orchard.

Peach and apricot trees will produce a light crop the third year after planting and a heavy crop the fourth year.

Plums begin bearing in four or five years after planting.

Sour cherries will bear in four years after they are planted, though it requires from six to seven years for sweet cherries to bear.

Figs will bear a light crop the second year after planting and a good crop the third year.

Grapes will bear a light crop the third year and a good crop the fourth year after planting.

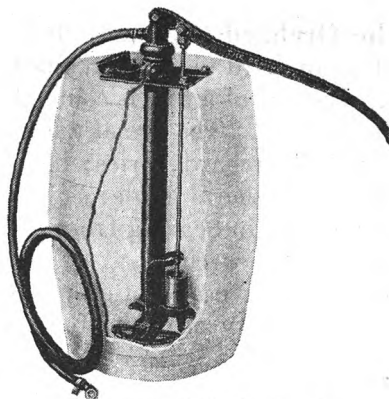
Pecans will bear a few nuts the fifth or sixth year after planting, but it takes the trees from eight to ten years to produce commercial crops.

Blackberries, dewberries, and raspberries will bear a light crop the second year and a good crop the third year after planting.

Strawberries set in the early fall will produce a light crop the following spring with a heavy crop coming the second spring after planting.

Spraying the Home Orchard.—Directions for spraying the principal fruits grown in the home orchard

will be found in the foregoing chapters dealing with these fruits. It will be necessary, however, to spray the fruits of the home orchard in groups to save time and material.



Courtesy of The Deming Company
BARREL SPRAYER

Plums and peaches may be grouped together and sprayed by the schedule given for peaches.

Apples and pears may be sprayed by the same schedule. Grapes are also sprayed with the same mixture, though the time of application differs somewhat. Bor-

deaux mixture and arsenate of lead is the summer spray used for these fruits.

Spray Outfit for the Home Orchard.—A barrel spray pump holding 50 gallons of spray solution is probably the most satisfactory and economical outfit for the home orchard. These pumps can be secured with either one or two leads of hose for applying the spray. This type of pump can be purchased at from \$10 to \$15. It can be set on a wagon and driven through the orchard as the trees are sprayed. This pump can also be used for spraying poultry houses and vegetable gardens. However, the small wheel-about outfits are possibly more convenient for the latter purpose. It is important, however, not to spray peaches with bordeaux mixture or any other spray containing copper salts, such as copper sulphate or copper carbonate, during the summer as they cause the leaves to shed.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. What fruits should be planted in the home orchard?
2. What fertilizers are used in the home orchards of your community?
3. How should a home orchard be cultivated?
4. How should the home orchard be pruned?
5. How long after planting does it take apples to bear? Pears? Peaches? Plums? Sour Cherries? Sweet Cherries? Figs? Grapes? Pecans? Blackberries? Raspberries? Strawberries?
6. How should the fruits be grouped for spraying in the home orchard?
7. What spray should be used on peaches and plums during the summer?
8. What spray should be used for apples, pears, and grapes during the summer?
9. What kind of spray pump should be used for the home orchard?

SUGGESTED EXERCISES

1. Draw diagrams of a few home orchards near the school and suggest what improvements should be made.
2. Study the sizes of home orchards in your community and collect as much data as you can on the fruit of these orchards.
3. Study the home orchards of your community and determine what insects and diseases are causing most damage.
4. Record in your notebook the dates of blooming of the different home orchard fruits and see which bloom nearest the last killing frost in the spring.
5. Draw a plan for a home orchard one acre in size and indicate the varieties and numbers of trees to be planted, using as a guide the suggestions given in the text. Se-

lect varieties suitable to the community in which you live and space the plantings according to their needs.

SEASONAL WORK IN THE HOME ORCHARD

September, October, and November

1. Turn the soil in the orchard and sow a winter cover crop of vetch, clover, or rye.
2. If the peach trees are three years old or older, use para-dichlorobenzene or ethylene dichloride around them about October 15 to kill the borers.
3. Prune the muscadine grapes in early November or after the first killing frost.
4. Clean up and destroy any mummied or diseased fruit from late varieties.
5. Dig the borers from the base of peach and apple trees.
6. Begin pruning fruit trees in late November.
7. Make cuttings of any grapes, figs, pears, or pomegranates which it is desired to propagate.

December, January, and February

1. Finish pruning all trees and spray with concentrated lime-sulphur solution or oil emulsion if San Jose scale is present.
2. Graft any apples, pears, or pecans which are to be propagated.
3. Spray peach trees with concentrated lime-sulphur mixture just before blossom buds swell to prevent the leaf curl disease.
4. Clean up any rubbish or trash about the orchard to destroy hibernating insects.

March, April, and May

1. Fertilize the orchard and turn under the winter cover crop.
2. Spray peaches, plums, apples, and pears. Continue to spray according to directions for spraying the several fruits given in previous chapters.

3. Thin peaches and plums which are crowded on the trees.
4. Cultivate the orchard each week or ten days to keep down weeds and grass.
5. Harvest, for family use or for sale, all fruit as it ripens.
6. Do not allow any fruit to decay on the trees or on the ground. Pick up and destroy all wormy fruit.

June, July, and August

1. Prune the small fruits, blackberries, raspberries, and dewberries, following directions given in the chapters on these fruits.
2. Continue to harvest fruit as it ripens.
3. Clean up all fallen and decayed fruit.
4. Can or dry any fruit not consumed or sold fresh.

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CHAPTER XXX

DEWBERRIES—SELECTING SITE AND PLANTING

Job 1—Selecting the Site for Growing Dewberries

Before attempting to grow dewberries on a large scale there are four questions that the prospective grower has to consider: (1) climatic adaptation of the region, (2) labor available, (3) markets available, and (4) facilities for transportation.

Climatic Adaptation.—While the dewberry is grown in quite a wide range of climates, it is more adaptable to the milder climates. In some sections where the dewberry is grown, it must be protected during the winter to save the canes from winter injury. It may be grown almost anywhere in the South, as far as climate is concerned. In some instances, where the field is too close to salt water, the vines are not thrifty.

Availability of Labor.—At certain seasons of the year the growing of dewberries requires much more labor than might be expected if the crop is given the attention that it needs, but the skill of the labor does not need to be of as high order as is required with most other fruit crops. The labor requirements in growing dewberries are well distributed throughout the year. The time of greatest requirement is during the harvest period when many hands are needed to pick the crop.

Markets.—The farmer, before planting dewberries, should determine whether or not he will grow the crop

for shipment or for local markets. In most communities there is a good demand for limited quantities of dewberries. Before planting for commercial purposes, the farmer should determine what markets he can supply and what competition he may expect on these markets. In his local community the amount of competition can be determined somewhat by finding out the production of other growers.

Transportation.—Transportation is one of the most important considerations of the dewberry grower. If the dewberries are being produced for shipment, it is highly essential that good rail service be provided. Refrigerator car service should be available, and freight rates should be favorable. If the dewberry field can be located close to the railroad or close to a hard-surface road, long hauls by wagons and jolting over rough roads, which bruises the berries, will be eliminated. Berries that are bruised do not hold up well in shipment. From the standpoint of local marketing a well-located dewberry field is of extreme importance. If the field is located near good roads, the crop may be placed upon the local market easily and the fruit will arrive there in an attractive condition.

If the farmer feels that conditions are favorable for the growing of dewberries in his community, he must then determine: (1) what acreage to plant, and (2) the most suitable site for planting.

Acreage to Plant.—Where the fruit is being produced for a local market, the amount of acreage to put in dewberries will depend very largely upon the amount of fruit the local market can consume. It is better to start with a small acreage and expand it gradually. This will give the grower an opportunity to determine the size of his market and prevent him from making an initial

planting that is too large. Where the fruit is being produced commercially, the market is not of the first importance as a limiting factor.

The amount of labor is always an important factor in determining the acreage to plant. Picking time requires more labor than any other period in the life of the dewberry plantation. From six to twelve pickers per acre are required, depending upon the size of crop and the type of labor employed.

The cost of growing dewberries is greater than with most field crops. The grower should take this fact into consideration and plant an acreage no greater than he can establish and properly operate.

Selecting the Site.—In selecting the most suitable site for dewberries, the grower will have to consider: (1) soils, (2) accessibility, (3) water drainage, and (4) slope.

The dewberry may be grown on a variety of soils. It does best on a soil that contains a large amount of sand. Even the poorest white sands, when properly handled, will yield excellent crops. The ideal soil, however, is a sandy loam with a clay subsoil. Sandy soils can supply the drainage and warmth which seem to be essential to the dewberry, but such soils contain little plant food, hold very little water, suffer badly during drought, and are less satisfactory than a sandy loam. A sandy loam contains sufficient sand to provide the necessary drainage, enough clay and vegetable matter to make the soil rich in plant food, and at the same time holds moisture better. The dewberry requires a large amount of moisture, especially while the fruit is developing and ripening. On poor, open, sandy soil it is often difficult to supply the crop with enough moisture while the fruit is ripening. Humus is important in an open porous soil.

It helps to make such soil absorb large quantities of water, and during a drought will retain moisture to a greater degree than a soil without humus.

Everything else being equal, a site that is readily accessible from the standpoint of good roads and railroads is desirable.

A dewberry field should always be thoroughly drained, for the plants will die if the soil is too wet and soggy. It is a waste of time and money to plant dewberries in low, wet soil, but many sites of this type may be excellent when tile-drained.

Slope.—The slope of the site should be away from the prevailing winds during the growing season. Winds during the ripening season, as a result of their drying effect, are injurious to the crop. The summer winds dry out the soil and also dry up the fruit.

The factor of atmospheric drainage is less important in the South than in other sections. Other things being equal, it is desirable to have the dewberry field located



Courtesy of George M. Darrow

A LUCRETIA DEWBERRY TRAINED TO
A LOW STAKE IN SOUTHERN NEW
JERSEY

on a slope or on an elevation somewhat above the surrounding country so as to have the protection of good air drainage. This will protect the blossom buds from late spring frosts.

Job 2—Procuring the Plants for Setting

After the farmer has decided to grow dewberries and has selected the site for the planting, his next job is that of securing plants for setting. This job involves making two decisions: (1) what variety to plant, and (2) how to secure the plants.

What Varieties to Plant.—The varieties that the grower selects will depend largely upon the adaptability to the section and the type of market.

The prospective dewberry grower should select varieties that have demonstrated their adaptability to the particular section in which they are to be grown. The grower may determine which varieties are best adapted to his section by securing information from his state agricultural institutions and by drawing upon the experience of growers.

The type of market will, in a measure, influence the selection of varieties. If the dewberries are produced for a distant market, it will be necessary to select varieties that are good shippers. If they are to be grown for a local market and home use, varieties of high quality should be selected.

Certain varieties of dewberries are sterile and need to be pollinated by other varieties. It is necessary then to know whether or not the varieties are self-fertile or self-sterile, and arrange the varieties so that the self-sterile ones may be properly pollinated.

There are very few varieties of dewberries grown. The Lucretia is the most important one grown from a

commercial standpoint, with the exception of the Mayes in Texas, and the Gardena in California. These three varieties are classed as self-fertile. The Mayes variety is considered by some to be the best home garden dewberry, but it is a soft berry and does not equal the Lucretia as a commercial shipper. The newer berries, the Youngberry and Boysenberry, are well adapted to growing in the South and the Youngberry in particular is now widely planted.

How to Secure the Plants.—Plants may be secured in one of three ways: (1) from nurserymen, (2) from nearby growers, and (3) propagated at home.

- In starting into the dewberry business for the first time, growers secure the plants either from a reliable nursery or from some nearby grower. The main consideration in securing plants is to see that good, well-grown, healthy plants are obtained. Dewberry growers having a field on the farm usually raise their own plants.

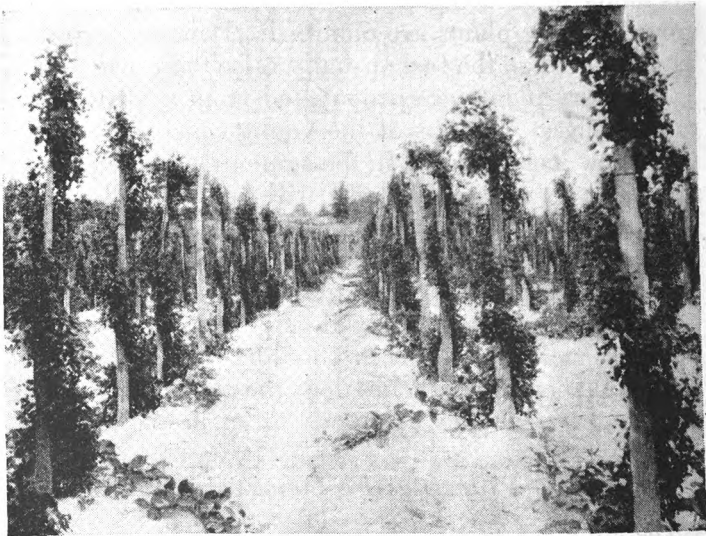
Dewberry plants are propagated from tips and from root cuttings. The tips of the young canes are covered with a few inches of soil in the summer. These covered tips will root and new plants will be ready for transplanting by late fall. The tips should be cut off four to six inches above the ground when digging. Select only the strongest plants for transplanting.

Root cuttings may be made by callousing over in winter in moist sand. They should be planted in rich, moist soil about three inches deep the next spring. After growing one year they are ready to set in the field.

Job 3—Planting the Dewberry Plants

The job of planting the dewberry plants requires two decisions: (1) how to prepare the land, and (2) how to set the plants.

Preparing the Land.—The amount and preparation will depend upon whether freshly cleared or cultivated land is selected and on the condition and type of the soil. Dewberries should not be planted on freshly cleared land. A cultivated crop should be grown for at least one year before setting the plants, and two years are better than one. In preparing any type of soil for the dewberry crop, it is well to begin two or three years before setting the plants. Many soils which are well adapted to dewberry growing contain a very small amount of plant food and little or no humus. These soils must be improved if the best results are to be obtained. Plant food and humus must be supplied in some form, and if this can be done before the plants are set it is of decided advantage. If cowpeas, soy-



Courtesy of George M. Darrow

A FIELD OF LUCRETIA DEWBERRIES IN NORTH CAROLINA BEARING A GOOD CROP THE YEAR AFTER PLANTING

beans, velvet beans, or clovers can be grown and turned under, the land will be improved and a large amount of humus added to the soil. Some of the poorest sandy loams will yield good crops of dewberries when treated in this way. The dewberry occupies the land for at least ten years, and for this reason the preparation of the soil should be more thorough than for annual crops like cotton and corn. Plowing should be very deep so as to supply a greater feeding surface to the roots, and to help retain moisture. The mechanics for preparing the land for dewberries is similar to good preparation for other crops such as strawberries or apples.

Setting the Plants.—The dewberry can be planted during the fall, winter, or spring. Usually, only fall and spring plantings are practiced, with most of the planting being done in the spring; in the South, fall planting is preferable. At this season of the year there is usually a large amount of moisture in the soil and the plants become more fully established, and do not dry out before the growing season commences the following spring. They make a much more vigorous growth and are better prepared to withstand drought the following spring or summer. Plants set in the spring are subject to drought. They are not well established when the growing season opens, and consequently, are unable to make a vigorous growth or withstand the hot weather of spring and early summer. If spring planting is practiced it should be done as early as possible.

The distance apart for setting the plants depends on the method of training. When the plants are trained to stakes they are usually set in squares with the general distance, five by five feet apart each way. On extremely rich soils the plants may be set closer, while on very poor soils, six by six feet apart each way will prove sat-

isfactory. When the plants are set in rows and the canes are trained to wires, the plants are usually set two to three feet apart in rows, with the rows four to six feet apart.

The plants should be set immediately after being dug, or after being received from the nursery. The planter should be extremely careful in protecting the roots from exposure, and this exposure should be reduced to an absolute minimum. The hole should be sufficiently large so that all the roots may be well spread out. It is highly important that the soil be packed firmly around the roots. If this is not done, open spaces often remain around the roots, with the result that they become badly dried out and many plants die.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Discuss climatic adaptation in relation to dewberry growing.
2. At what time is there the greatest labor requirement in dewberry growing?
3. Discuss markets in relation to dewberry production.
4. Discuss transportation in relation to dewberry growing.
5. How many pickers are required per acre for dewberries?
6. How does the cost of growing dewberries compare with most field crops?
7. Discuss desirable and undesirable soils for dewberries.
8. Is water drainage important with dewberries?
9. Discuss the relation of slope of site to dewberry growing.
10. Is the factor of atmospheric drainage important in your section?
11. Do you think dewberries would be a profitable crop in your community?
12. What factors determine the varieties that the grower will plant?

13. How do these factors influence the selection of these varieties?
14. Name three varieties of dewberries.
15. What variety is most important in your section of the state?
16. How are plants secured?
17. By what methods are dewberry plants propagated?
18. The amount of preparation for dewberries will depend upon what factors?
19. Should dewberries be planted on freshly cleared land?
20. Discuss preparation of land for dewberries.
21. When is the best time to set the plants?
22. When are they generally set in your community?
23. What is the advantage of setting in the fall?
24. What are the disadvantages of spring setting?
25. Discuss the operation of setting the plants.

SUGGESTED EXERCISES

1. Make a survey of the territory served by the school regarding the number of dewberry fields, condition of vines, attention they have received, and the profitableness of the crop. Use this information in an effort to determine whether or not the section is adapted to commercial dewberry growing, or dewberry growing for local markets.
2. The class should make a field trip with the idea of picking out poor and good dewberry sites in a community.
3. Secure specimens if possible of the principal varieties of the community and write descriptions of them.
4. Visit dewberry fields in the community and study how plants are propagated by root tips.
5. If you have a dewberry project, secure the dewberry roots and make some root cuttings, callous these over the winter in moist sand, and plant in rows in the field next spring.
6. Visit dewberry growers in the community and find out how they prepare the land for their fields and set the plants. Try to find growers who are preparing fields for planting, so that you may have an opportunity to study actual preparation and setting.

CHAPTER XXXI

DEWBERRIES—MANAGEMENT AND MARKETING

Job 4—Tilling and Fertilizing Dewberries

The job of tilling and fertilizing dewberries requires three decisions: (1) when to plow and cultivate, (2) type of implements to use, and (3) how to fertilize.

The cultivation of the dewberry must be very thorough and it should start soon after the plants are set. The soil must be mellow, moist, and absolutely free from weeds. Under no circumstances must young dewberry plants be allowed to battle with weeds.

During the second and later seasons, cultivation should be done immediately after tying up the plants. Cultivation should be continued as long as young growth will permit. The plant requires an enormous amount of water at the time the fruit is ripening. The fruit enlarges rapidly at this time, and the amount of available moisture has a decided influence on the size of berries. If the amount of moisture is not sufficient the berries will be small, and if the soil is very dry the berries often shrivel and never ripen. The number of cultivations during the season will vary, depending upon seasonal conditions. During some years once a week is not too often especially if conditions are favorable for weed growth.

Implements.—The type of cultivator to use will be one of medium size and one that does not plow too deeply but that helps pulverize the soil.

A disk cultivator should be used followed by one composed of a large number of small teeth so that a perfect mulch may be kept on the surface and the soil never allowed to become hard or crusted. The disk and tooth cultivator may be hitched in tandem oftentimes cutting



Courtesy of George M. Darrow

TRAINING SYSTEM OFTEN USED FOR THE DEWBERRY—A TWO-WIRE VERTICAL TRELLIS

the cost of cultivation to a large extent. If the weeds cannot be destroyed close to the crown of the plant by the cultivator, it will be necessary to use hand hoes.

How to Fertilize.—The subject of fertilizers is one of the most important in dewberry culture. If the soil is poor and sandy, large quantities of plant food must be supplied. The use of fertilizers for this crop is governed by the same principles that apply to their use with other fruit crops. The fertilizer problem is largely a local one which each grower must solve for himself.

Usually two applications are made during the year,

one in early spring immediately after tying up the plants, and another in summer after the plants have been cut off.

It is generally considered that the spring application has a direct influence on the fruit crop. The canes have already been made during the previous season and cane growth during the early part of the season is of secondary importance. Growers generally consider that this application should consist largely of potash and phosphoric acid, with a small amount of nitrogen. For the spring application, 500 to 600 pounds per acre of fertilizer analyzing 4 percent nitrogen, 8 percent phosphoric acid, and 8 percent potash are recommended for most sandy soils of the South. Another application is made immediately after the vines have been cut off. This application is for the purpose of making canes during the remainder of the growing season which will produce next year's crop. Since nitrogen is the most important element in making cane growth, fertilizers used at this application should consist largely of this material.

Job 5—Training and Pruning Dewberry Plants

The job of pruning and training dewberry plants involves two decisions: (1) what type of training to use, and (2) how to prune.

Training Dewberry Plants.—Two methods are commonly employed in training dewberries, one known as the stake method and the other as the wire method. The stake method is the more desirable and the one most often used, the wire method being used only in regions where stakes are too expensive.

In the stake method, stakes about seven feet long are placed in the ground two feet deep, near each plant.

The stakes are generally two to three inches square and should be strong, rigid, and durable. Much care should be taken in setting them so as not to injure the crown of the plant. They should be placed at least two or three inches from the center of the crown and driven into the ground so that they will stand in a perfectly upright position. With this system less cultivation is required, because the plants are equally spaced in both directions and horse cultivation can be practiced. Very little hand labor is required. The operation of picking is greatly facilitated and fewer soft berries result.

The wire method is practiced in those sections where it is impossible to get stakes economically. Generally, the two-wire method is employed in preference to the one-wire method. The first wire is placed about two feet from the ground and the upper wire about five feet from the ground. Strong posts are set forty feet apart in the row, along which a No. 9 wire is stretched. With this method cultivation can be practiced in one direction only, increasing the amount of hoeing.

One of the most important operations is tying up the plants. Where the stake method is used the vines are carefully gathered together, coiled around the stake in a spiral form and generally tied at the top and again near the middle. Some growers tie them in three places. The cord used should be soft so as not to injure the canes, and the cords should not be drawn too tightly so as to injure the vine. The vines are usually so long that they will need to be cut off just above the end of the stake. Where the wire method of training is used the tying of the plants to the wires is very similar to that described for the stake method.

How to Prune.—The manner and type of pruning depends upon the climate and the diseases present.

In southern dewberry sections, the old and new canes are cut off close to the ground at the crown of the plant immediately after the fruit has been picked. A special type of long-handled shears is used for this practice, the steel blade curved upward in such a manner as to enable the pruner to cut the canes close to the ground with little stooping. The canes are removed from the field and burned. Cultivation is then started and fertilizer is applied. This induces a vigorous new growth on which the fruit for the next year will be produced. The new canes are allowed to run on the ground where they are left until spring, then they are tied up.

Job 6—Controlling Dewberry Diseases and Insects

Anthracnose and double blossom are the two most serious diseases of the dewberry. The anthracnose disease occurs upon leaves, leafstalks, and fruits. The most important seat of attack, however, is upon the canes, which are girdled and die as a result, about the time the berries would ripen, and upon the berries, which become brownish and dried out. "Scabby" berries are a result of infection by anthracnose. The disease impairs both the yield and quality of fruit. When the infection occurs while the berries are young, they often become brown and dry and fail to ripen. If the berries have already begun to ripen, they are of poor quality and unattractive in appearance. The disease makes circular, slightly sunken, grayish patches on the canes. These spots vary in size from specks to patches one-eighth to one-fourth of an inch across. The disease on the leaves is characterized by the presence of straw color to yellowish brown spots about the size of a pin-head. These spots are bordered by a purplish margin.

The dead portion of the specks usually drop out, and as a result, the leaves have a very ragged appearance.

The double blossom disease is most abundant on the Lucretia which is the most common variety grown. The disease makes its appearance in the spring just as the leaf buds are opening, although it can be detected previous to that time by the enlargement of the diseased buds. When the flower buds open they show a great variety of deformities. Even those flowers which appear most perfect are affected and the fruits from these are always worthless.

Until recently these diseases have been combated in the South by cutting off, removing, and burning all the canes immediately after harvesting the crop. Vigorous new canes, free from disease, are produced after the pruning. During the last few years anthracnose has been so severe that additional control measures have been found necessary. Spraying with bordeaux mixture is used to prevent infection of the new vines. Three applications during the season are necessary; the first is given in midsummer when the canes are about twelve inches long, the second the next spring after the plants have been tied up, and the third immediately after blossoming. It is necessary to carefully remove all the old canes so as to destroy the source of infection, and a thorough job must be made of the spraying with the entire spray schedule followed.

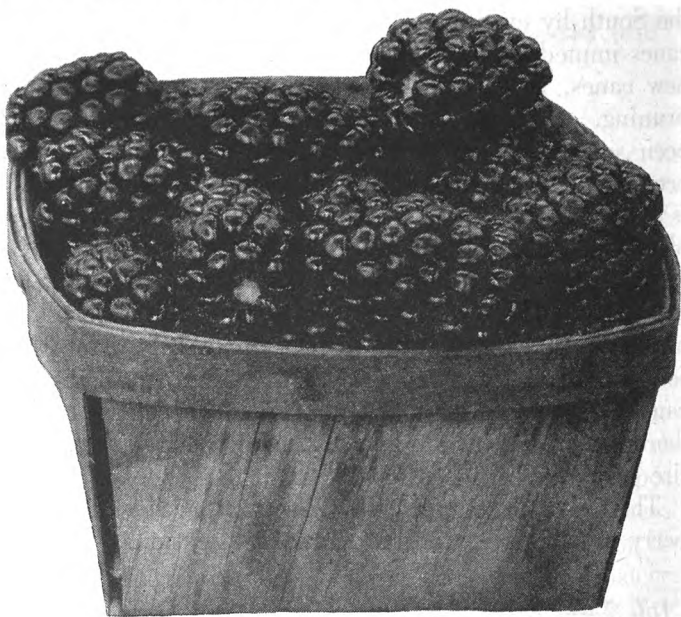
There are practically no insects attacking the dewberry to such an extent as to merit attention.

Job 7—Harvesting and Marketing Dewberries

The marketing of dewberries successfully depends upon: (1) good fruit, (2) careful picking and uniform grading, (3) good packing, and (4) proper selling.

The job of harvesting and marketing dewberries requires six decisions on the part of the grower. He must decide: (1) when to pick the berries, (2) how to manage pickers, (3) what kind of containers to use, (4) how to pack, (5) how to ship, and (6) how to sell.

When to Pick.—It is somewhat difficult to establish a standard for the degree of ripeness at which to pick dewberries and see that the pickers follow this standard. Of course, the desirable degree of ripeness depends somewhat on the distance to market. If the fruit is to be shipped, it should not be picked until it is fairly



Courtesy of George M. Darrow

FRUIT OF THE YOUNG DEWBERRY (YOUNGBERRY)

A high-flavored dewberry especially adapted to home gardens in southern and Pacific Coast states. It is especially valuable for freezing and preserving.

well colored, yet it must be picked before the berries become thoroughly ripe, since it must be firm for commercial purposes. For the local market the berries should be allowed to get fully ripe on the vines before picking. The local market is the most difficult market for which to pick satisfactorily because the pickers are certain to pick a portion of the crop which is not yet ripe.

It is hardly necessary to emphasize the importance of great care in picking the fruit. The fruit should not be picked while it is wet. Probably more fruit is lost in transportation because of this one difficulty than from any other cause. When the fruit is wet it rots rapidly and cannot be shipped any great distance. Never pick immediately after a rain or a heavy dew. Care should be taken to keep the berries out of the sun after they have been picked. Exposure to hot sun causes them to turn reddish, detracting from their bright appearance and quality and reducing the length of time that they will hold up in shipment.

How to Manage Pickers.—The picker should have close supervision so that the fruit is handled carefully. A great deal of damage may be done if the berries are thrown into the boxes instead of being placed in them. If the pickers are trained to use the thumb and two fingers in picking the berry instead of the thumb and one finger, it will have less pressure exerted on it, and therefore is in less danger of being injured. Only a few berries should be held in the hand at a time. It is better if only one berry is placed in the box as it is picked. When badly bruised, no treatment after picking will remedy the bad effects resulting from poor picking. As soon as the fruit is picked it should be rushed to the packing house. Often berries remain in the field for hours after being picked. Fruit should be put in the shed as soon

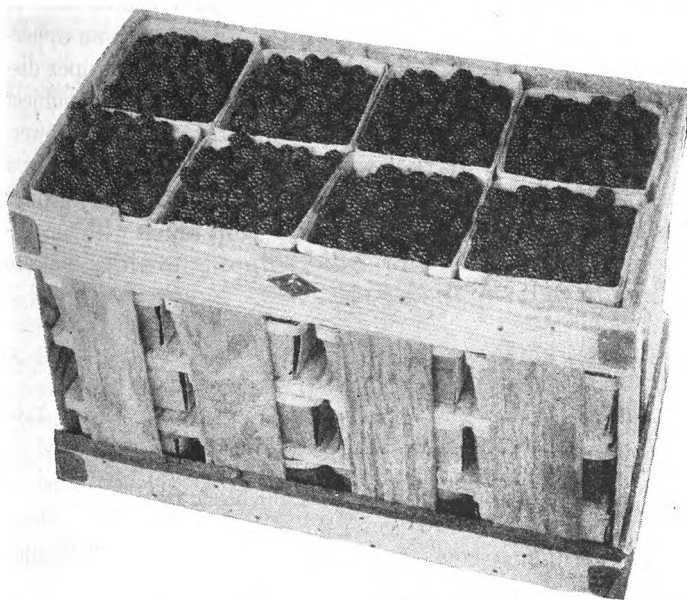
as possible after picking and kept cool. To leave it in the hot, broiling sun will ruin it in a short time. The plantation should be picked over frequently. Usually, every other day will be sufficient for any particular plant. With unusually warm weather, especially when it follows a rain, it may be necessary to pick every day.

What Kind of Containers to Use.—The pickers should be equipped with carriers similar to those used with strawberries. These hold from four to eight quart baskets. In the South the berries are usually picked in quart baskets which are packed in crates holding either 16 or 32 baskets.

How to Pack.—Usually the fruit is picked directly into the receptacle in which it goes to market. The only packing practiced in the shed is a slight rearrangement of the top layer of fruit in the quart. This is to make the basket appear attractive and to have it filled to the proper fullness. If the quarts are filled too full, there is great danger of the fruit on top being badly mashed. All unnecessary handling should be avoided, hence the importance of careful picking in the field. If many stems are left on the fruit in the quarts, it detracts from the appearance. The usual type of packing shed is similar to the type used by the strawberry growers in the South.

How to Ship.—If the fruit is to be shipped to a commercial market, it will be shipped either by express, transport truck, or freight in a refrigerator car. If shipped by express, the cost of marketing is increased considerably. Much of the early fruit is shipped by express, but the bulk of the crop is shipped in trucks or refrigerator cars. Around 200 crates are put in a refrigerator car, being placed two layers deep, six layers

wide, and sixteen layers lengthwise in the car. In an average car this gives 192 crates; sometimes eight additional crates are added to the car, these being placed on the top of the second layer near the end of the car. In



Courtesy of George M. Darrow

A 32-QUART CRATE OF LUCRETIA DEWBERRIES GROWN IN NORTH CAROLINA

loading the car the crates should be packed so as to allow a good circulation of cold air around the crates. There should be no shifting or jarring of crates in the car. This is prevented by nailing small slats across the ends of the crates, which holds them snugly in place.

How to Sell Dewberries.—Except in those sections of the country where the growing of dewberries has been developed as an important crop, there is usually a good

local demand for the fresh fruit. Nearly every town will use the entire output of a large plantation if the fruit is of high quality and pack, and if it is delivered to the consumer fresh and ripe. Where the industry is highly developed, shipping in refrigerator cars is practiced. In these instances, the grower has an opportunity to sell f. o. b. to carlot buyers. The proper distribution of the fruit at the various markets is a subject which must receive the best attention of the grower. Very often one market will be flooded, while there is a scarcity of the product in another market. If the grower is shipping, he should keep closely in touch with the different markets so as to avoid shipping to cities that are already well supplied.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Discuss the cultivation of the dewberry field.
2. When should plowing be done in the spring?
3. What implements are best used in plowing and cultivating the dewberry field?
4. Discuss the fertilization of dewberries from the standpoint of amount and type of fertilizer used.
5. What is the purpose of each application?
6. What methods are commonly employed in training dewberries?
7. Describe the stake method.
8. Describe the wire method.
9. Discuss tying up the plants.
10. Discuss the pruning of dewberry vines.
11. What are the two most serious diseases of the dewberry?
12. How are they controlled?
13. Describe the anthracnose disease.
14. Describe the double blossom disease.

15. When should dewberries be picked?
16. Should dewberries be picked when wet?
17. Is there any danger in exposing dewberries to the sun after picking?
18. Discuss the management of pickers.
19. Discuss the packing of dewberries for market.
20. Discuss the packing of dewberry crates in a refrigerator car.
21. Discuss the selling of dewberries.

SUGGESTED EXERCISES

1. In visiting the dewberry fields of your community, study the types of cultivation used, determine when plowing is done, and how often the plants are cultivated.
2. Study the types of implements used in plowing and cultivating dewberry fields.
3. Determine the method of fertilizing employed by dewberry growers in your community and the amounts and kinds of fertilizers applied.
4. Write to the state agricultural college for their recommendations on fertilizing dewberries.
5. Visit the dewberry fields in the community and study the methods of training employed. Also ascertain when and what method of pruning is practiced. Determine which methods seem to be most successful.
6. If possible, each member of the class should get some practice in tying up a few individual vines, according to the system used in the community.
7. Visit nearby dewberry fields and determine the diseases present and the method of control used.
8. Secure specimens of vines, leaves, and fruit showing characteristic injury of the diseases common in your community. Study methods until you can identify them.
9. Visit the local dewberry fields and study methods of picking and types of packing sheds.
10. Learn to determine when dewberries are ready for picking.

SEASONAL WORK WITH DEWBERRIES

January, February, and March

Put in stakes on which to train plants. Tie up vines. Cultivate regularly to conserve moisture. Spray vines with bordeaux mixture immediately after tying up. Make first application of fertilizer.

April, May, and June

Secure baskets for packing crop. Cultivate regularly. Spray with bordeaux mixture immediately after blooming. Harvest crop. Cut off vines and remove and burn them. Apply a second application of fertilizer.

July, August, and September

Spray with bordeaux mixture when about twelve inches long. Cultivate. Cover root tips for new plants.

October, November, and December

Prepare land for new field. Dig up plants. Make root cuttings. Set plants.

CHAPTER XXXII

BLACKBERRIES—GROWING AND MARKETING

Job 1—Selecting the Land for Blackberries

The abundance of wild blackberries in most parts of the South has no doubt been mainly instrumental in preventing a great interest in this fruit crop. Blackberries can be grown in most parts of the South, but the southern farmer seems to prefer the dewberry.

Site.—The keeping quality and appearance of blackberries are seriously affected by hauling over rough roads, and for this reason the planting should be close to good roads so that the berries may be placed on the market soon after harvesting. The site should be protected from drying winds during harvest time. If there is a possibility of a choice of slope, one to the north is generally preferable because of the protection from both wind and sun.

A plentiful supply of moisture for the plants during the ripening period is the most important consideration in the selection of a site. The finest fruit is produced when there is an ample supply of moisture in the soil during the ripening period.

Soil.—Blackberries are hardy and will produce a partial crop on almost any type of soil. The ideal soil for blackberries is a deep, fine, sandy loam well supplied with humus. The finest berries and the largest yields are secured where humus and soil condition are such that the plants are supplied with a plentiful supply of moisture, especially during the ripening period.

Acreage to Plant.—There are very few blackberries grown for commercial markets in the South. Most plantings are to supply local demands, home use, or both. If the crop is grown for the commercial market, the acreage will be determined by the amount of labor

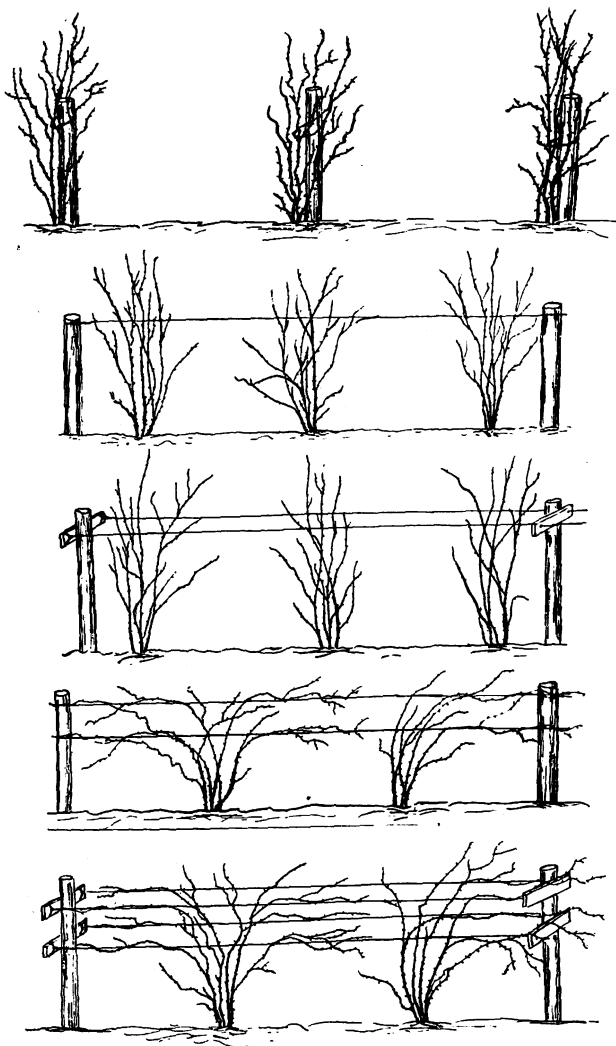


BLACKBERRY PRODUCTION IN THE UNITED STATES

Each dot represents 500,000 quarts.

and capital available. This demand will depend upon the supply of blackberries and other fruits at the same season. An acreage no greater than that necessary to supply the demand should be planted. It is better to start with a small acreage and extend the planting gradually. This will afford an opportunity to determine the extent of the demand and prevent the error of making the first planting too large.

Where the planting has been given good attention, blackberries will yield on the average of from 2,000 to 2,500 quarts to the acre. In some sections and under certain conditions, a yield of 4,000 to 5,000 quarts may be secured. This depends upon the varieties and the conditions under which they are grown.



Courtesy of George M. Darrow

METHODS OF TRAINING BLACKBERRIES

(a) Trained to stakes to hold the cane erect, (b) trained to a one-wire trellis to hold them erect, (c) trained to a two-wire horizontal trellis, (d) semitrailing blackberries trained to a two-wire vertical trellis, and (e) semitrailing vines trained to a four-wire trellis.

Job 2—Procuring the Plants

The farmer should select varieties that have demonstrated their adaptability to the section in which they are to be grown. The grower may determine this by drawing upon the experience of blackberry growers in the section and by securing information from his state agricultural institutions. The temperature factor is of relatively small importance in the South as it is mild enough in most sections to grow the most tender varieties. These should not be planted where the temperature goes to zero or below. There are certain varieties which are adapted to dry or semi-arid conditions. The McDonald is the most important of these varieties. The Early Harvest is the variety most generally grown in the South, but it is very susceptible to rust.

Early Harvest: This variety is productive but very susceptible to rust. The berries are small in size, firm, and of good quality. Season very early.

Eldorado: One of the best varieties. It is very resistant to rust. The fruit is medium to large in size, firm, flavor sweet, quality very good. Season is early and extends over long period.

McDonald: This variety is a blackberry-dewberry hybrid. It should be planted with another variety which blooms at the same time as it is nearly self-sterile. The fruit is firm and the quality is very good. The season is very early, the berries ripening two weeks before the Early Harvest. It is very productive and the plants are drought resistant.

Snyder: This variety does not rust badly, but cannot stand dry weather. It is not adapted to heavy clay land. The berries are of medium size, firm, and of good quality. The season is short.

Taylor: Somewhat resistant to rust. This is a late variety. It is only moderately productive. The berries are medium in size, soft, and of very good quality.

How to Secure the Plants.—The main consideration in securing plants is to see that good, well grown, vigorous, healthy plants are secured. If there are no



Courtesy of George M. Darrow

THE ERECT-GROWING BLACKBERRY TRAINED TO A STAKE

plants from which to propagate additional plants, the new plants are purchased from either a nursery or a nearby grower.

Blackberries are propagated from either suckers or root cuttings. Blackberries produce two kinds of canes, one type which grow from the crown, and another type,



Courtesy of George M. Darrow

THE ERECT-GROWING BLACKBERRY PRUNED BACK IN WINTER SO
THAT THE CANES HOLD THEMSELVES ERECT

which are commonly called suckers, which come up from the roots at various distances from the parent plant. New plants may be secured by digging up these suckers. Where vigorous plants can be secured, they are very satisfactory.

In using the root cutting method, roots of the desired variety are dug up during the fall and cut into pieces about two to three inches long. While larger or smaller sizes may be used, those the size of a pencil are desirable. It is desirable to callous these cuttings during

winter and then to plant them horizontally about three inches deep in the spring. By fall plants with a strong root system are produced. These are better plants than are usually secured by the sucker method.

Job 3—Planting Blackberries

The job of planting blackberry plants involves two decisions: (1) how to prepare the land, and (2) how to set the plants.

Preparing the Land.—The method of preparing the land depends to some extent upon the previous treatment and the character of the soil. In any case, the land should be planted to a cultivated crop the season previous to setting the plants. This will put the soil in the best condition and will eradicate some of the insects that



Courtesy of George M. Darrow

ERECT-GROWING BLACKBERRIES TRAINED TO STAKES

often attack the young plants. The soil should be plowed to a depth of about eight or nine inches, thoroughly disked, and harrowed. A deep, fine condition of the soil is most desirable.

Setting the Plants.—Blackberry plants are set in the early spring or late fall. In most sections the best results are secured with very early spring plantings. When the plants are set in early spring, the site should be plowed in the fall so that it may be put in good condition early.

In the South blackberries are planted according to two methods. Planting in rows seven to nine feet apart with the plants two and one-half to three feet apart in the row is most commonly used. This permits cultivation in but one direction. The other method permits cultivation in two directions, as the plants are set either five feet by five feet or six feet by six feet.

The plants should be set immediately after being dug or after being received from the nursery. The grower should exercise every precaution in protecting the roots from exposure so that they will not become dry. The hole should be large enough to receive the roots without cramping them, and the dirt should be packed firmly about the roots to prevent them from drying.

Job 4—Cultivating and Training Blackberry Plants

Tillage should begin as early in the spring as possible, and should be continued at intervals throughout the season in order to keep a dust mulch around the plants. Clean cultivation will conserve moisture by keeping down suckers and weeds. Tillage should be shallow so as not to injure the roots. The blackberry has roots close to the surface of the ground, and if these are cut it increases the number of suckers.

How to Fertilize.—Some growers do not use any fertilizer with blackberries while others use very liberal amounts. Where the soil is very rich, deep, and moist, there is not much need for fertilizers, but if soil condi-



Courtesy of George M. Darrow

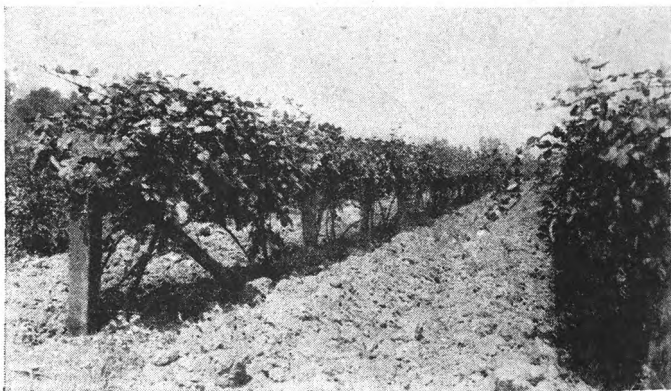
THE LOGAN BLACKBERRY (LOGANBERRY) TRAINED TO A VERTICAL TRELLIS IN WESTERN OREGON

tions are different, it will generally be found to pay. Stable manure is the best fertilizer to use because it adds humus to the soil in addition to plant food. Applications of from 10 to 25 tons to the acre may be used. Some growers recommend exercising precaution in using nitrogen after the plants have come into bearing. They believe that the rapid cane and leaf growth produced by such fertilization interferes with production.

Systems of Training.—In training blackberries, growers employ the following systems: (1) no supports;

(2) posts and one wire; (3) posts, cross pieces, and two wires; (4) posts and two wires; and (5) posts, two cross pieces, and four wires.

In those sections where the plants do not grow large, the new canes are pinched off when they have reached a height of two and one-half to three feet. In this system



Courtesy of George M. Darrow

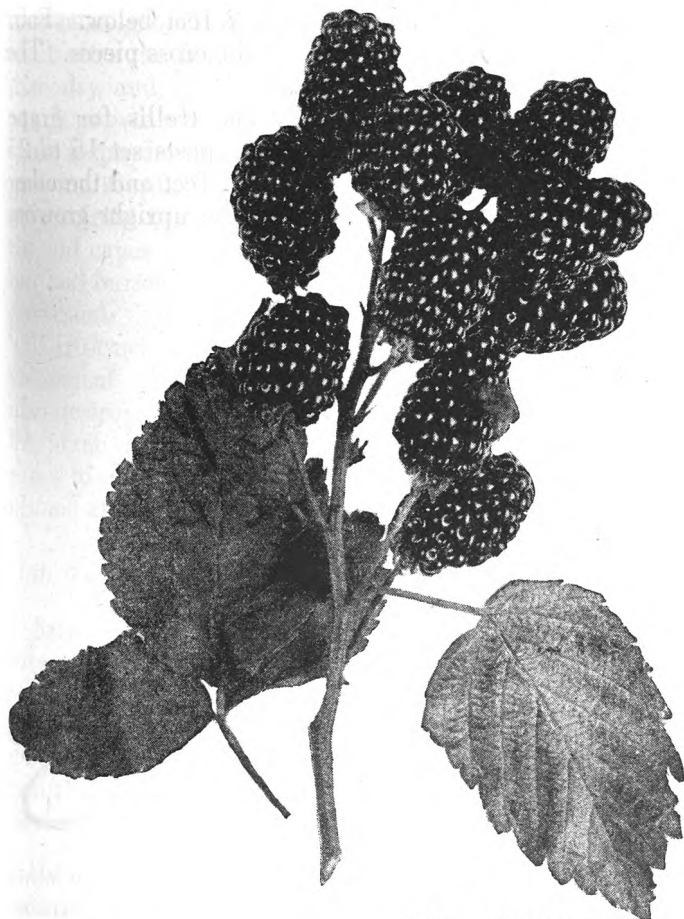
A FIELD OF THE HIMALAYA BLACKBERRY TRAINED TO A TWO-WIRE HORIZONTAL TRELLIS WITH THE WIRES TEN INCHES APART AND THREE FEET HIGH. COVINA, CALIFORNIA

the canes are generally broken by tillage implements and by the pickers with the result that the quantity of fruit is decreased.

The different systems in which the plants are supported more than pay for themselves in the increased amount of fruit and in convenience of harvesting. One system commonly employed is that of posts at intervals of 30 feet with a single wire stretched along the posts about $2\frac{1}{2}$ feet from the ground. Canes are trained to this wire. They are kept upright which makes it convenient to cultivate the field and to harvest the crop.

Another system of training consists of nailing cross

pieces 18 inches long to the top of the posts. Two wires are stretched along the ends of the cross pieces. The cross pieces are nailed to the posts so that the wires are from 2½ to 3 feet high. The canes are left inside these

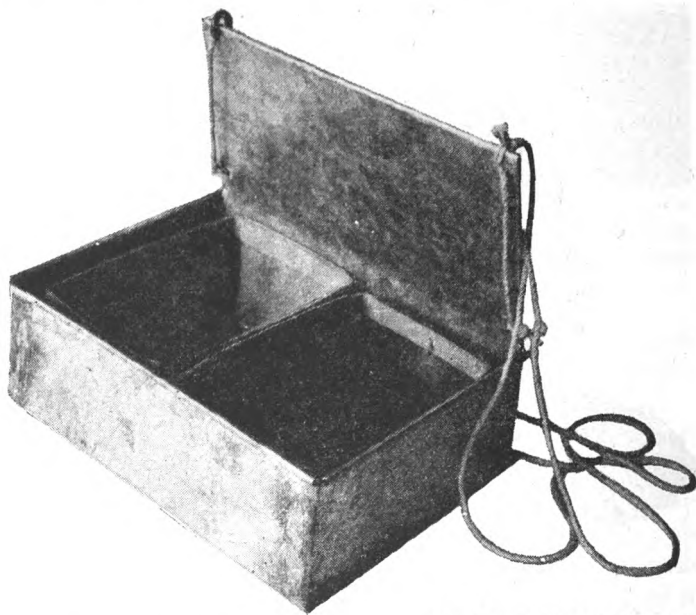


Courtesy of George M. Darrow

A FRUIT CLUSTER OF EARLY HARVEST BLACKBERRY

wires which support them on either side. Where more vigorous plants are produced and where varieties that grow high are used, the system in which two cross pieces 18 inches long are nailed to each post is commonly employed. One of the cross pieces is nailed at the top of the post and the other one about 2 feet below. Four wires are strung along the ends of the cross pieces. The canes are trained along the wires.

Another system is similar to the trellis for grape vines. Two wires are strung along posts set 15 to 25 feet apart. The top wire is about 5 feet and the other about 3 feet from the ground. The upright growing



Courtesy of George M. Darrow

A WAIST CARRIER FOR PICKING RASPBERRIES AND BLACKBERRIES
DESIGNED SO THAT IT WILL NOT SPILL BERRIES WHEN PICKER
BENDS OVER IN PICKING

varieties are tied to the wires, while those with more vinelike characteristics are trained along the wires.

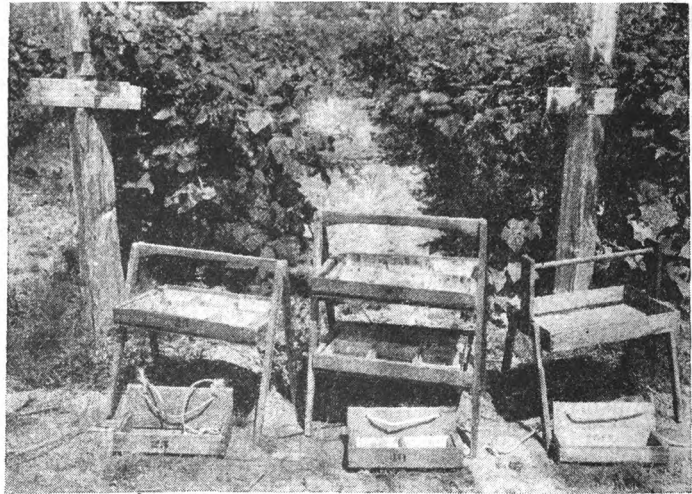
How to Prune.—The canes of the blackberry live for two years while the roots survive for many years. The canes grow from the crown in the spring and live until after the fruiting season of the next year. They then dry and are supplanted by canes of the current year's growth which have come up from the crown. The fruit is produced on canes which are in their second growing season. Suckers are produced at various distances from the parent plant. In pruning blackberries the old canes which have just borne fruit should be cut out and burned immediately after the berries have been harvested. This practice permits the young canes which will fruit next year to have a better opportunity for development. Insects and diseases on the old canes are also destroyed by this pruning. All the suckers around the plant should be pruned away. Three or four new canes to each plant should be selected and all the rest pruned at the same time that the old canes are removed.

Job 5—Harvesting and Marketing Blackberries

Because of the fact that many varieties turn black before ripe, blackberries are often picked too green. For home use berries should be left until they are full ripe and begin to soften. For shipping to markets the berries should be picked while still firm, even at the expense of quality. If picked while still firm, the fruit handles and carries well.

How to Manage Pickers.—The pickers should have close supervision to see that the fruit is handled carefully. Great care should be emphasized in picking the fruit. It should never be picked while wet, for wet fruit

rots readily and will not remain in good condition very long. Care should be exercised to keep the berries out of the sun after they have been picked. Exposure to sun causes them to turn reddish, which detracts from their appearance and the quality is injured. The berries should be carefully picked, for they are easily damaged if thrown into boxes instead of being placed. Pickers should pick directly into quart boxes which are carried in trays holding six or eight boxes. The fruit should be taken to the packing shed as soon as possible after picking. The plantation should be picked over frequently; usually, every other day will be sufficient for any particular plant.



Courtesy of George M. Darrow

WAIST AND HAND CARRIERS USED IN PICKING RASPBERRIES AND BLACKBERRIES

Kind of Containers.—Pickers should be equipped with trays or carriers holding from four to eight quart baskets similar to those used with strawberries and dew-

berries. The berries may be packed in crates holding 16 to 32 quart baskets.

Marketing Blackberries.—Where blackberry growing is developed as a commercial industry, shipping in refrigerator cars, trucks, or by express is practiced. In these instances the fruit is generally sold through commission men. Occasionally, the grower has an opportunity to sell f. o. b. to carlot buyers. Proper distribution of the fruit at various markets is a subject which must receive the best attention of the grower. Except in those sections of the country where production of blackberries has been developed as an important crop, there is usually a good demand for the fresh fruit in the nearby towns. Another important outlet is the sale of blackberries to wineries.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. In selecting the land for blackberries, the southern farmer will need to consider what factors?
2. What are the main factors to be considered in selecting a site for blackberries?
3. What is the main consideration in the selection of a site?
4. What determines the acreage to plant to blackberries?
5. The job of procuring the plants for planting involves what decisions?
6. Name the most important varieties of blackberries.
7. What is the principal variety in your community?
8. How may plants be secured?
9. How are blackberries propagated?
10. Describe the method of securing plants from suckers.

11. Describe the root cutting method of propagating.
12. The job of planting blackberries involves what decisions?
13. What three decisions will the farmer have to make in planting blackberries?
14. When are the plants commonly set in your community?
15. What two methods of planting are commonly used with blackberries?
16. Which one is used in your community?
17. The job of cultivating and training blackberry plants involves what decisions?
18. What systems of training are employed with blackberries?
19. Describe these different systems.
20. Describe the fruiting habit of the blackberry.
21. Describe the pruning of blackberries.
22. The job of harvesting blackberries involves what decisions?
23. When should blackberries be picked?
24. Discuss the management of pickers.
25. Discuss the packing of blackberries.
26. Discuss selling blackberries.

SUGGESTED EXERCISES

1. Make a survey of the territory served by the school, securing information regarding the number of blackberry fields, condition of vines, attention they have received, and profitableness of the crop. Use this information in an effort to determine whether or not your section is adapted to blackberry growing for commercial purposes or for local markets.
2. Visit nearby blackberry plantings to determine the names of varieties grown and which varieties have given the best results; to study how the plant forms canes from the crown and suckers from the roots some distance from the crown; and to observe what pruning methods are used and what systems of training are employed.

SEASONAL WORK WITH BLACKBERRIES

January, February, and March

Secure plants for planting. Set plants. Plant out root cuttings to produce plants. Cultivate thoroughly.

April, May, and June

Cultivate thoroughly. Keep runners out of rows.

July, August, and September

- Cultivate thoroughly. Harvest fruit. Prune out old vines and remove from plantation. Prune new canes so that only three or four are left to each plant.

October, November, and December

Dig up roots for root cuttings. Plow ground for spring setting.

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CHAPTER XXXIII

STRAWBERRIES—SELECTING LAND AND PROCURING PLANTS

Job 1—Selecting the Site for Growing Strawberries

Strawberries may be grown almost anywhere for home use, but before a farmer can determine whether or not he can grow them successfully in an extensive way, he must consider carefully the following factors: (1) climatic adaptation of the region, (2) amount of capital that will be required, (3) amount and kind of labor required, (4) market outlets, and (5) facilities for transportation.

Climatic Adaptation.—The strawberry may be grown almost anywhere in the South so far as climate is concerned. It is probably grown under a wider range of climatic conditions and gives satisfactory results under a wider range of conditions than any other of our fruits. The plants are more vigorous and productive in cooler climates than where the temperatures are higher. Nevertheless, strawberries are grown successfully throughout the South and some of the most extensive commercial areas have been developed in southern states. From the standpoint of climatic adaptation, the most important consideration is the one of securing a location where the berries ripen during a period when the markets are not supplied from other sections.

Capital Required.—The expense of bringing an acre of strawberries into profitable bearing is greater

than most prospective growers will estimate. The cost varies greatly, depending upon the location, kind of soil, and weather conditions during the growing season. A survey of some very successful growers in the South brings out the information that it will cost from \$100 to



STRAWBERRY PRODUCTION IN THE UNITED STATES
Each dot represents 500,000 quarts.

\$150 to produce an acre of strawberries. Some growers estimate that they can produce an acre for \$50 to \$75, but this will not be the average. In some sections the costs are around \$200 per acre and over.

The cost per quart of production ranges from around 3 cents to 9½ cents f. o. b. shipping point. Figures in the South have been estimated at around \$70 to \$150 per acre for growing, and from \$60 to \$125 for picking and packing, or total expense of \$130 to \$275 per acre for growing and marketing the crop.

Labor Required.—The problem of labor in handling strawberries is a very important one. It has ac-

quired such importance in the leading strawberry states that the state departments of labor and employment bureaus make special efforts to organize armies of pickers so that the crop may be properly harvested. The departments of labor, in some states, through their employment bureaus, have been of immense value in supplying pickers and organizing them so that they are made available to strawberry growers.

An important consideration from the standpoint of labor is to have sufficient help at the peak of the season and not an over-supply of help when picking is slack. From four to ten pickers are usually necessary to handle an acre of berries.

Market Outlet.—The farmer, before planting strawberries, should determine whether or not he will grow the crop for shipment or for local markets. In practically every community throughout the South, there is a good demand for a limited quantity of strawberries. Before planting for commercial purposes, the farmer should determine what markets he can supply and what competition may be expected on these markets. In his local community the amount of competition can be somewhat determined by finding out the production of other growers.

It is well to determine the sources of supplies on the markets to which the grower expects to ship. It is well also to determine when these markets are supplied with berries. The grower may find that his section ripens berries at a time that enables him to supply markets that are relatively unsupplied at that time. He may find also that markets are being supplied by growers at a great distance over which he may have tremendous advantage because of nearness.

The South contains many important commercial straw-

berry districts. The bulk of the berries produced in these districts are shipped to northern markets. The season of ripening in these particular districts makes a sequence of shipping periods. Florida begins the strawberry procession by shipping a few berries from the



Courtesy of George M. Darrow

A STRAWBERRY FIELD PLANTED ON THE CONTOUR TO PREVENT WASHING

Plant City district early in December. During January and February, Florida shipments increase with the shipments coming from the northern part of the state. Florida growers have possession of the market until about March 1. At this time Texas and Louisiana begin to ship. These two sections increase their shipments until the middle of March. Then berries from south Mississippi and Alabama are placed on the market. The last of March or the first of April, central Mississippi, Alabama, Louisiana, and Texas are shipping steadily, with Florida beginning to lessen the amount of shipments. Arkansas, North Carolina, and South Carolina come into

the market during the first part of April, closely followed by western Tennessee. By the middle of April, Florida has disappeared from the market. Arkansas and North Carolina shipments increase towards the end of the month. From the tenth to the fifteenth of May usually closes the season for Alabama, central and southern Arkansas, Mississippi, and the Carolinas, at which time the Ozark section, Kentucky, Tennessee, and Virginia begin. From the middle of May until the middle of June the Delaware and Maryland growers have possession of the market.

The following table shows the relative importance of different southern states as commercial shippers of strawberries. These figures are reported by Census of Agriculture for 1940:

State	Acreage	Production in 1,000 Quarts
Alabama.....	3,771	6,925
Arkansas.....	14,188	16,690
Florida.....	8,066	14,666
Georgia.....	830	640
Kentucky.....	8,205	11,217
Louisiana.....	15,311	19,559
Maryland.....	6,238	8,169
Mississippi.....	421	669
North Carolina.....	5,991	10,268
South Carolina.....	582	675
Tennessee.....	12,927	17,343
Texas.....	2,218	3,174
Virginia.....	7,448	11,476

Transportation Facilities.—Transportation facilities are of extreme importance from the standpoint of growing strawberries for market. Refrigerator car service should be of the very best and freight rates should be favorable if the grower expects to make a success in a commercial way. It is desirable to have the strawberry field as near the loading station as possible.

The character of the road is important in influencing

the condition of the berries. Strawberry fields may be farther from the shipping point if the roads are smooth. If the strawberry field can be located close to the railroad, or close to a hard surface road, long hauls and jolting over rough roads which bruise the berries will be eliminated. Berries that are bruised do not hold up well in shipment. From a local market standpoint, it is highly desirable to have the field located near good roads so that the fruit may be placed on the market in an attractive condition. Also if the field is located so that it is easily accessible, many people will come to the field to purchase their strawberry supplies.

Acreage to Plant.—If the grower is producing fruit for a commercial market, the market is not of first importance in influencing the acreage to plant. If the fruit is being produced for local market, the amount of acreage to plant will depend very largely upon the amount of fruit that the local market can consume. The farmer had better plant only a small acreage and expand it gradually as he determines the amount of demand.

The amount of labor is of importance in determining the amount of acreage to plant. The grower should plant an acreage no greater than can be given careful attention. Picking time requires more labor than at any other period.

The cost of growing strawberries is much greater than most field crops and other small fruit crops. The grower should first determine what that cost is in his section and plant an acreage which he can establish and properly operate.

Selecting the Site.—Strawberries are grown successfully on a wide range of soils, but the best soils are those ranging from a sandy loam to a very light clay loam. Varieties of strawberries vary in their adaptability to

types of soil, but more varieties will be successful on light soils. Very stiff, heavy clays are least adapted to this fruit. In most of the southern strawberry sections where earliness is of prime importance, light soils are used. These tend to hasten the maturity of the plants and fruit, and are important in sections where earliness is desirable. Light soils, however, suffer more from drought and do not produce as many berries, or berries of as high quality, as heavier soils. Very heavy soils are difficult to prepare and to keep in the proper physical condition. In North Carolina, certain phases of the Norfolk sandy loam series are employed. In Texas, gumbo soils and both coarse and fine sandy soils are used. Sandy loams and heavy silt loams are used in Louisiana. Silt and coarse sandy loams, and in some instances muck soils, are used extensively in Florida. In each of these sections the soil type most easily managed, and the one that contains the most humus, generally gives the most satisfactory results. The very sandy soils contain little plant food, hold very little water, suffer badly during drought, and are less satisfactory than sandy loams. The sandy loams contain enough clay and vegetable matter to make the soil rich in plant food, hold moisture well, and at the same time contain sufficient sand to provide the necessary drainage. The strawberry is a fruit which requires a large amount of water. For this reason, open sandy soils often fail to supply the crop with enough moisture. Humus is important in such soil as it helps to make it compact and to retain the moisture to a greater degree during drought.

The question of water drainage is very important in growing strawberries, for the plants will die if the soil is too wet and soggy. There are some sites that are too low and wet without drainage to plant in strawberries, that may prove excellent if tile-drained. A site must be

selected on which the water never stands. In many strawberry sections of the South this is extremely important, for the land is usually poorly drained. In some fields that are poorly drained, the plants are stunted, and in many cases drowned by too much moisture during periods of heavy rains. Diseases are generally less abundant on sites where the drainage is good.

Most strawberry growers do not give much consideration to the slope or exposure of the field. In most strawberry-growing sections there is very little opportunity for choice, as the land is practically level, but where there is an opportunity for choice, the field should always have a slope in some direction so that good drainage may be secured, because standing water is very injurious to the beds. On fairly well-drained soils, where the location is level, the plants are likely to suffer from too much moisture in winter and early spring.

In sections where frost is a serious factor in causing damage at blooming time, the question of slope and air drainage in relation to protection from frost might well be considered by the grower. Other things being equal, the grower should select a site which has some slope so as to provide atmospheric drainage. The grower might well consider, too, slope in connection with earliness. In those sections where earliness is of extreme importance, a southern slope may mean several days earliness in the crop.

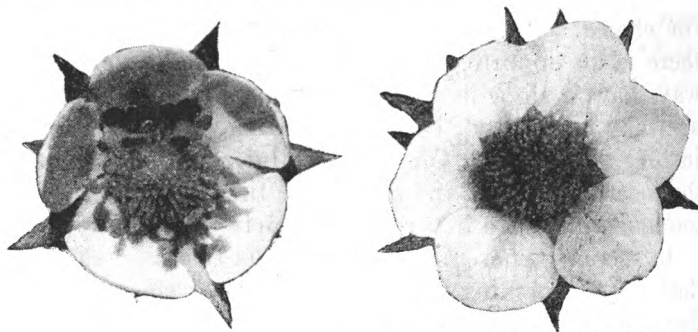
Atmospheric drainage is very closely associated with slope in that the greater the slope, generally, the more protection against frost.

In the South nematodes are often present in the soil and do considerable damage to strawberry plantings. Nematode-free sites should be selected. Nematodes are most abundant and more injurious in sandy soils than in heavy soils. Wherever possible, new land or land that

is known to be free from nematodes, should be used for strawberries. Where old land is used, or land that is known to contain nematodes, it will be necessary to give several years of preparation before planting the berries so that the land may be freed from the trouble.

Job 2—Procuring the Plants for Setting

The selection of suitable varieties is one of the most important things to be considered in the commercial



Courtesy of George M. Darrow

FLOWERS OF THE STRAWBERRY

Perfect flower on the left: (a) stamens and (b) pistils. Imperfect flower on the right: with imperfect stamens.

planting of strawberries. In no other class of fruits are there so many varieties to choose from. Some varieties seem to be well adapted to certain sections such as a sandy soil and a warm climate, while others do better in a heavy clay soil and a cool climate. The prospective strawberry grower should select varieties that have demonstrated their adaptability to the particular section in which they are to be grown. The grower may determine which varieties are best adapted to his section by securing information from his state agricultural institutions, and by drawing upon the experience of nearby straw-

berry growers and nurserymen. In the South varieties need to be selected that make quick plant growth and fruit in early spring before extremely hot weather.

Adaptation to climate is one of the first considerations in the selection of strawberry varieties. There is a great variation among strawberry varieties in this respect. In the South the Blakemore, Missionary, and Klondyke are the three principal varieties. They make a quick growth in early spring, produce a large crop of berries early, and are excellent shippers. These varieties have attained prominence in a large measure because they ripen fruit at a season when there is little competition from northern-grown berries. There are other varieties that produce good crops in the South, but they are unprofitable from a commercial standpoint because they ripen their fruit at a time when they must compete with local berries in the North. It is imperative that the southern grower select varieties that he can ship to markets when they are not supplied from other districts more favorably located.

Soil conditions are less important than climatic requirements. However, they are worthy of consideration. The Aroma and Gandy varieties are much more choice than the Klondyke which seems to be adapted to a wide range of soils. The Gandy gives best results on a clay loam, while the Aroma is successful on fairly heavy soils such as a heavy silt loam. These varietal differences seem to be explained by the type of root system and the amount of moisture which they can secure from different soils. Some varieties, such as Chesapeake, give splendid results under garden conditions where intensive culture and, in some cases, irrigation may be provided.

The type of market is a very important factor in the selection of varieties. If the berries are being produced

for distant market, a variety that is productive, that ripens at the right time, and that is a good shipper will need to be selected.

It is well in selecting varieties to know whether the plants have perfect or imperfect flowers. The perfect flowers have stamens and pistils and are capable of pollinating themselves. Those known as imperfect flowers have pistils only and are not capable of bearing fruit unless pollinated by some perfect-flowered variety. In selecting a variety having imperfect flowers, care should be taken in planting to have every third or fourth row of a variety with perfect flowers to insure ample pollination. Where strawberries are grown on a large scale for distant shipment, it is generally advisable to select only varieties having perfect flowers. Where mixed varieties are planted, it is almost impossible to have pickers keep the varieties separated, and unsatisfactory results are often secured because of the mixture. One of the varieties may be more tender than the other, and the contents of the entire package usually presents an unattractive appearance when it reaches the market.

For home use and to supply local market, a much longer list of varieties will be advisable than is the case where the crop is grown for commercial purposes. For local market it is important to select varieties that produce fruit over a long period of time. Particular attention should be paid to quality.

Blakemore: The berry is medium to below medium size, from light red uniformly colored to the center. Early. Adapted to regions where Missionary and Klondyke are grown or from Georgia to New Jersey. A very vigorous plant maker. At the present time the leading variety in the United States, constituting about 25 percent of the total acreage of the country. A good shipping berry and promising for preserving.

Klondyke: The berry is of medium size, globose, inclined to

conic in shape, very firm, a deep crimson in color to the center, acid in flavor, and fair to good in quality. Midseason. It is grown almost exclusively in all parts of the South Atlantic and Gulf Coast States except in central Florida and in certain parts of North Carolina and the Cullman region of Alabama. Its foliage is very resistant to disease and its fruit very firm and deep crimson in color. It is one of the best shipping varieties and is especially adapted to market purposes.

Missionary: The berry is below medium in size to large, conic in shape, soft to very firm, according to the section in which it is grown, dark crimson with dark red flesh, acid, quality fair to good. Early midseason. This variety is the standard kind for central Florida, and is grown extensively in the eastern part of North Carolina, and in the Norfolk region of Virginia. The berry, however, is softer than the Klondyke in North Carolina and in Virginia, and is not considered as desirable as the Klondyke. In central Florida the berry is very firm and excellent for shipping. For Florida, because of its ripening season, its firm attractive fruit and the freedom of its foliage from leaf spot, it is considered more desirable than any other sort.

Aroma: The berry is large and globose-conic to short wedge shape. Flesh firm, bright crimson surface and light red inner, mild subacid, quality good. Season, midseason to late. The foliage is very healthy and the plants make runners freely. This variety is the principal one in Kentucky, northern Arkansas and southern Missouri. It does best on fairly heavy soil. It is one of the best shipping varieties. It is productive and the foliage is disease resistant.

Chesapeake: The berry is large, globose-conic to short wedge shape. Flesh firm, bright crimson on the outside with prominent seed, light red or whitish inside. Flavor mild, subacid. Quality very good. Season late. This variety is very desirable for home use and for local markets. The foliage is remarkably healthy but the plants make few runner plants except in very rich, moist soil. It does exceptionally well under irrigation.

Gandy: The berry is irregular, globose-conic, firm, deep

crimson with red flesh. Flavor brisk, subacid. Quality good. Season late. The plants make runners freely, foliage is generally healthy, but in some sections susceptible to attacks of leaf spot. The Gandy is the principal commercial variety in New Jersey and Delaware and is grown in Tennessee and Kentucky.

In setting a strawberry field for the first time it will be necessary to secure the plants from either a reliable nursery or from some nearby grower. The main consideration, regardless of the source of plants, is to secure good, well-grown, healthy plants.

As with any other fruit stock, the order should be placed just as early as possible so as to secure best plants of the desired varieties. Certain dealers advertise pedigreed plants; by this they mean that the plants are grown from selected and especially strong and prolific mother plants. This method would appear to be very sound in theory, but with the present knowledge and results from such practice, it is extremely doubtful whether or not the planter should pay any more for such plants than other well-grown stock. Nurserymen can supply excellent plants provided they are packed with care and every precaution taken so that they will not dry out en route. The plants should be shipped in bunches of 25, packed in selected crates with the roots surrounded by Sphagnum moss, tops out, and exposed. When properly packed the plants weigh from 22 to 30 pounds per thousand plants. The plants should be planted as soon as received, but if they arrive before the ground is prepared, or if not desirable to plant immediately, they should be heeled in or temporarily planted close together in a trench. The bunches should be cut open and the plants spread in a thin layer in a trench. Southern growers who wish to buy northern-grown plants may find it advisable to do so late in the fall. In some

cases it is difficult to get them early enough in the spring.

In securing plants from nearby growers they should be selected with care. Never use plants from a bed that has fruited. Only strong plants should be grown and no old plants should be set. One-year-old plants are best. If a plant reveals many large, black roots, it is probably old and should be discarded. If the plants are in plantbeds, dig up the whole row, throwing out the old plants. If the plants are dug from the side of the rows, only the smaller weaker plants are secured. It is much more advisable to dig the entire row. When selecting plants from any type of bed, be careful to discard all small weak plants and all old or parent plants. Plants with vigorous roots and small leaves are always to be preferred to plants with small roots and large leaves. Some growers use the well-formed runners on the outside of fruiting rows, but these are not the best plants.

In many sections home propagated plants are best if they have been properly grown. They are often fresher and make a better growth than nursery plants.

To secure the best results with home propagated plants, a special propagation bed should be used. Many growers make a practice of taking their plants from fruiting rows of old beds. This method does not give as successful beds as where the plants are grown in a particular bed which has been set aside for propagation purposes. It is better practice to set a bed each year for the purpose of supplying plants and to dig this bed entirely, selecting the best plants and discarding the undesirable plants.

The strawberry is propagated by means of runners. These are long, slender stems produced by the mother plants. At the joints a cluster of leaves is produced and later roots are sent down and a new plant is formed.

Each stem may produce from one to four plants. In examining the propagation bed it will be apparent that there is some variation in the size of first and last plants developed on any runner stem. The plant nearest the mother plant may be equally as large as the parent with many leaves and a large root system. The last plant set generally is rather weak with few roots and few leaves. It is desirable to select those plants that have large vigorous roots with small leaves. The plants should come from mother plants that have not fruited.

In various sections of the South different methods of producing plants are used. In Florida, where nematodes are serious, the growers obtain a limited number of plants each year from the North. These new mother plants are set from January to March. By June these plants have developed a sufficient number of runner plants to set a much larger area. By August the runner plants set in June are ready for transplanting. The main fruiting field or bed is planted in October or November from the runner plants developed from the August-set plants. This practice enables the grower to have a sufficient number of plants to set his field with only a small outlay from his original stock of plants. This practice gives more satisfactory results than where the plants are ordered from the North in the fall and set to produce the fruit the following winter.

In North Carolina many of the growers secure the plants each year from northern nurseries, but the most successful growers have worked out methods of producing plants at home in a satisfactory manner. The common practice in Virginia and North Carolina strawberry sections is to either secure plants in February or March from the North, or from local fields known to be free from nematodes, and to set the permanent field, or to set plants in January to March from which to raise run-

ner plants to set fields in August and September. In the Hammond, Louisiana section, growers use these two methods. In the first method, mother plants are secured from the North which are set from January to March. From the middle of June to the middle of July, the best runner plants are set to a large area. In October to December the best of the runner plants formed from the summer setting are used to plant the permanent field. In the second method, from the middle of June to the middle of July, the best runner plants from a bearing field, which has been cultivated and weeded out after the picking season, are set for making plants. The best runner plants from these are transplanted in October to December for the permanent fruiting field. In the South it is highly important to exercise every precaution to avoid obtaining plants infested with nematodes and other troubles prevalent in certain sections. In digging plants for transplanting, the work should be done with a spade, a spading fork, or a trowel. In case individual plants are dug, the trowel will prove most satisfactory. Extreme care should be exercised to prevent injury to the root systems.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Before planting strawberries in a commercial way, what is the important decision that the farmer has to make?
2. What are the principal factors that must be taken into consideration in making this decision?
3. How much capital per acre is generally required for growing and marketing a crop of strawberries?
4. What district ships the first berries?
5. When do strawberries ripen in your community?

6. Give the shipping seasons for the different southern strawberry districts.
7. Name the principal strawberry-growing states in the South in order of their importance.
8. How does your own state rank in comparison with other southern states?
9. After deciding that conditions are favorable for growing strawberries, what decisions must the prospective grower then make?
10. The acreage to plant will depend upon what factors?
11. What factors should be considered in selecting a site for the strawberry field?
12. In most of the southern strawberry sections, what type of soil is used?
13. What is the ideal type of soil for strawberries?
14. Compare light and heavy soils for strawberry growing.
15. What is the advantage of the sandy loam type of soil?
16. What is the effect of poor drainage on strawberry plants?
17. Discuss the question of slope in relation to strawberry production.
18. In selecting a site for strawberries, discuss the importance of avoiding nematodes.
19. What are the principal varieties of strawberries grown in the South?
20. What is the important thing to consider in selecting a variety for shipping?
21. How may strawberry plants be secured? Which is the best way?
22. How are strawberries propagated?

SUGGESTED EXERCISES

1. Make a survey of the territory served by the school to determine the acreage devoted to strawberries; the amount of the shipments; the extent of the local market; the returns made by the growers; and other information that will indicate how well the local community is adapted to strawberries.

2. Study the statistics on strawberry production in the United States and in a graphic way record in your notebook the place that your own state occupies with respect to production, time of ripening, and price received, as compared with the other states that grow strawberries in commercial quantities.
3. Make a field trip to study varieties; the propagation of plants; to distinguish between young and old plants; and to secure blossoms of perfect and imperfect flowers.

CHAPTER XXXIV

STRAWBERRIES—PLANTING AND CARE

Job 3—Planting the Strawberry Plants

The proper preparation of the land before planting strawberries is highly essential for the best results. Many fields suffer from poor preparation of the soil before planting. In preparing the land for strawberries the grower will need to consider: (1) whether the land is freshly cleared or has been cultivated, (2) the presence of nematodes, (3) the fertility and humus content, (4) how to plow and cultivate land, and (5) the rotation used.

Freshly Cleared or Cultivated Land.—There is a difference of opinion among growers as to whether newly cleared land or land that has had previous cultivation is most desirable for planting strawberries. Newly cleared land is usually more easily cultivated due to fewer weeds with which to contend. Some growers are of the opinion that this kind of soil will produce better fruit and larger yields than land that has been in cultivated crops. There are many soils that will need from one to three years' preparation before they are in the best condition to set to strawberries. Among such soils are those lacking in humus; those that are lacking in fertility; those that bake easily and do not retain moisture readily; those that contain nematodes; those that contain white grubs; and those that become weedy with quack grass, bermuda grass, and nut grass. All of

these need previous preparation before setting the plants. Sod land, or land that is covered with grass and weeds, should not be used because it is generally infested with white grubs. The weedy land is difficult to handle because of the work necessary to control the weeds. Land of this nature generally requires two seasons to get it in the best condition and to free it from grubs. If strawberries are planted on land infested with large numbers of white grubs, heavy loss of plants almost invariably results because of the roots being eaten by the grubs. Sod land should always be planted to a cultivated crop for two seasons after it is first plowed before planting to strawberries.

Fertility and Humus.—The fertility and humus content of the soil is of extreme importance in strawberry growing. Some authorities consider that it is almost impossible to get the soil too fertile for the best results. The fertility should be well distributed throughout the soil and should be of more lasting type than that which comes entirely from commercial fertilizers. In any case, an ample supply of moisture and a liberal amount of readily available plant food must be present in order to promote the growth necessary to make strawberry production profitable.

Because of the great need of humus in most southern soils, growers should grow some crop like cowpeas, soybeans, or velvet beans to turn under in the fall, or a crop of rye through the winter to increase the vegetable matter in the soil. This will provide a liberal amount of humus which is particularly important because of its influence upon the productiveness of the soil and its moisture holding capacity.

Plowing and Harrowing.—The soil should be put in perfect condition for planting by proper plowing and

harrowing, so that it will be pulverized and mellow. In the actual preparation of the land for strawberries it should first be plowed deeply. From six to eight inches is the common depth, but some growers plow as deep as ten inches. Where advisable plowing should be done in the fall. If the land is so steep that the soil would wash, the plowing may be done as early in the spring as the soil is in good condition for working. In any case, plowing should be done long enough before the plants are to be set to give plenty of time for the soil to firm, and so that capillary connection will be re-established. After plowing, the land should be disked several times until it is in fine condition. To allow several days between each disking is sometimes desirable. After disking, various types of harrows may be used. Some times both the spring-tooth and smoothing harrows are used with splendid results. Strawberry soil should be compact. If the plants are set on loose or lumpy soil there will not be a good stand. The surface condition of the land for planting should be fine and smooth. Sandy soils are oftentimes rolled to make them compact. If the soil is not firm at planting time, the rains that follow will compact it and the crowns of the plants will be left above the surface. In some districts of the South the plants are set on small beds or ridges 3 to 12 inches above the furrows. This is to secure drainage and is employed in those sections where the land is practically level and drainage is poor.

Rotations.—In certain sections where strawberry growing has been continued for some years, the production of the berries often takes a definite place in the rotation of crops. Just what crops will be used in rotation with strawberries vary according to the section. There are several principles, however, which should

govern the grower in deciding upon a rotation: (1) the land should be planted to some crop that requires thorough cultivation, the more cultivation the better, the year before setting to strawberries; (2) somewhere in the rotation there should be a crop, preferably a leguminous one, that is plowed under to increase the humus content of the soil; and (3) in the South three or four years ought to elapse between strawberry crops. This helps eliminate nematodes from the field and reduces other fungus and insect pests.

In North Carolina some of the growers use a rotation in which corn is planted after strawberries, with either Brabham or Iron cowpeas drilled in the rows. The cowpeas are turned under and winter oats are planted. The next spring the oats are harvested or plowed under and corn and cowpeas planted again. When the corn crop has been harvested and the cowpeas turned under, strawberries are planted in the fall. In some sections, during the second year in the rotation, Irish potatoes are substituted for corn. Irish potatoes are followed by soybeans or cowpeas which are turned under in the fall and then the plants are set.

Time to Plant.—In the South it may be generally said that strawberry plants can be set successfully in either spring or fall. Moisture and the nature of the soil are the determining factors regulating the time of planting. As a matter of fact, plants may be set any time in the South whenever the soil is right. Newly set plants must have plenty of moisture. Fall setting in sandy soils is more desirable than in clay soils. Most of the commercial fields in the Gulf States are planted from September to March. In Alabama, Georgia, Mississippi, and Louisiana, plants set in November and December make considerable growth during the winter and

produce about half a crop in the spring. There is some spring planting in these sections. Along the Gulf coast of Texas strawberries are set in October to December. In south Arkansas fall planting is employed, while in north Arkansas most growers plant in the spring. In the Atlantic coastal region of the country from Delaware



HOW DEEP TO SET PLANTS

Too deep, but covered (*left*); set correctly (*middle*); and plant set too near the surface (*right*).

down into South Carolina, both fall and spring planting is employed. In Florida planting is done from August to October.

System of Training.—In starting a strawberry field the prospective grower must decide which system of training and planting shall be used. There are two principal systems used in the South, with modifications of each. These are the hill system and the matted-row system. While these two systems are used throughout the South generally, the hill system predominates in the southern part of Texas, Louisiana, Mississippi, Alabama, Georgia, and South Carolina; in the southeast

corner of North Carolina; and throughout the State of Florida. The matted-row is commonly used in the middle and northern sections of the above mentioned states.

In using the hill system, the plants are generally set in single rows but in some sections of the South they are set in double and triple rows. When the single row is employed the rows are 3 to 3½ feet apart, and the plants 12 to 18 inches apart in the row. Where the double rows are used they are from 12 to 24 inches apart with alleys 2 to 4 feet apart between the double rows. In those sections where planting in three rows is practiced, the rows are set 20 to 24 inches. The single row hill system is used in the Hammond, Louisiana section, the Chadbourn district of North Carolina, and the central part of Florida. When the hill system is employed, the plants are generally set in late summer or fall. Plants set at this time generally make no runners and will produce a crop during the winter or the following spring, depending upon the district.

In home gardens strawberries are frequently planted in beds four or five rows wide. This is of an advantage where there is only a small amount of land available and is not practical under commercial conditions in the South. Where this system is employed in gardens, the plants are usually set 15 inches apart each way and cultivation is given with hand and wheel hoes.

The matted-row system is in common use in the Chadbourn and Mount Olive districts of North Carolina and in the Norfolk, Virginia section. It is used as the principal system in certain other sections throughout the South. The distance between rows and between plants in the row depends mainly upon the ability of the variety to make plants and upon a plentiful supply of moisture and general freedom from insects and diseases. Varieties like the Klondyke which make plants freely

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may be set farther apart than varieties that are poor plant producers. There are two types of this system, the narrow matted-row and the wide matted-row. The type depends upon the amount of space that the plants are allowed. The narrow matted-row is about one foot wide while the wide matted-row is about two feet wide. The system employed also influences the distance between the rows. Three to four feet between rows are allowed in the narrow system, and from four to six in the wide system. In these systems the plants are set from 15 to 36 inches apart in the rows. The following table shows the number of plants required to set an acre at different distances.

NUMBER OF PLANTS TO THE ACRE

<i>Distance Between Plants. Inches.</i>	<i>Distance Between Rows. Inches.</i>	<i>Plants to the Acre.</i>
12	12	43,560
12	24	21,780
15	15	28,878
15	30	13,939
15	36	11,616
15	42	9,953
18	30	11,616
18	36	9,680
18	42	8,297
24	24	10,890
24	30	8,712
24	36	7,260
24	42	6,223
24	48	5,445
30	36	5,808
30	48	4,356

Laying off the Land.—Many growers do not give much attention to laying out the rows for planting. Nevertheless it is important to have the rows straight.

There are many methods employed for marking the land; the simplest is with the garden line. Often peg and wheel markers are used. Any method that provides for straight rows may be used.

Setting the Plants.—Many strawberry fields have not been successful because a poor stand was secured as a result of the lack of proper care in setting the plants.

When the plants are secured from a distance they should be ordered so as to arrive at a time when the planting can be done immediately. If planting is delayed the plants should be opened as soon as they arrive and "heeled in." If heeled in loosely, plants are likely to die. In heeling in, the earth should be packed firmly around the roots to prevent drying out before they are set in the field.

In preparing plants for setting, clip the roots to about 4 or 5 inches and cut off about half the leaf growth, exercising care not to injure the crown. Ordinarily two leaves are left.

If possible, set the plants on a cloudy day in late afternoon. At any rate, protect the plants at all times from drying out by keeping the roots moist and protecting the plants from wind. In planting, it is well to keep them in moist sacks. The plants should not be dropped far ahead of the setters. This precaution is especially important on dry and windy days.

There are four precautions to exercise in successfully setting strawberry plants: (1) the plants should be set so that the crowns are even with the surface of the ground after the soil has been packed about the roots. The strawberry has a definite crown, and if this is set too deeply the bud becomes covered with soil, is severely weakened, and in many cases will die. If the plant is set too high, some of the root system is exposed and be-

comes dried out and generally dies; (2) the roots of the plant should not be twisted or cramped but should be spread out well; (3) the soil must be firmly in contact with the roots. Every precaution must be exercised to see that the soil is pressed firmly about the roots; and (4) after planting, the topsoil should be left loose to aid in the run-in of rain.



Courtesy of George M. Darrow

A MATTED ROW OF THE BLAKEMORE STRAWBERRY IN WESTERN
TENNESSEE

The plants are generally set with a spade, but a trowel, dibble, the hands, or a transplanting machine may be used. When the spade is used, two men can work together, one to use the spade and the other to set the plants. The man with the spade inserts it into the soil and pushes it forward, making a hole in which to put the plant. After the plant has been inserted, and the roots spread properly, he withdraws the spade and firms the soil around the roots with the foot or by in-

serting the spade into the soil a few inches in front of the plant and pressing it toward the plant.

When the plants are set with a dibble or a trowel, an opening five to seven inches deep is made in the soil. The roots of the plant are placed in the hole and the earth pressed firmly about them. Usually four men constitute a setting crew when this method is used. One



Courtesy of George M. Darrow

A CLOSEUP OF A HILL OF STRAWBERRIES AS GROWN IN THE FAR SOUTH

man makes the holes with the dibble or trowel, a second member of the crew drops the plants, and the others set the plants in the holes and firm the soil about the roots.

Tobacco, sweet potato, and cabbage transplanting machines are sometimes used successfully where the land is level and moist, and cloudy conditions prevail for a few days after setting. One man drives the machine and two others place the plants into it. The plants are watered when a machine is used. Whatever the method of

setting the plants, the surface soil should be smoothed into a loose mulch about the plants immediately after they have been set.

Job 4—Caring for the Strawberry Field

The management of the strawberry field may involve (1) removing flower stems, (2) pinching off runners, (3) thinning plants, (4) cultivating, (5) mulching, (6) fertilizing, and (7) renewing the beds.

Removing Flower Stems: The production of fruit is a severe strain on the vitality of newly set plants. Flower stems are often produced on newly set plants that are planted in either winter or spring. These should be removed until the plants become firmly established. Better plants are produced than if they are allowed to produce fruit. Where runners or new plants are needed, as in the matted-row system, more runners will be produced if the flower stems are removed. After the plants become thoroughly established in the soil and a sufficient number of runner plants have been established, the flowers need not be cut off.

Pinching off Runners: The management of the runners is dependent upon the variety and soil conditions to a certain extent, but it depends principally upon the system to which the bed is set. If the hill system is employed, then all runners must be removed throughout the season. This prevents crowding the plants and permits the mother plant to form strong crowns instead of becoming exhausted in the formation of new runner plants. The runners should be removed as soon as they start. With the matted-row system, it may be necessary to remove very few runners; however, it may be often necessary to remove superfluous runners or plants if the best results are to be secured. To secure the best crops, the

runner plants ought to be far enough apart to allow each individual plant enough space to develop a large crown. Plants should be about six inches apart for satisfactory results. To keep the plants in the matted-row out of the alleys, roller cutters may be attached to the cultivator. Some growers thin their beds under this system by running across the rows in late summer or early fall with a spike-tooth harrow. When this is done the teeth are slanted backward. In using this implement, only those plants with weak root systems are torn up. It is sometimes necessary to do some thinning with a hoe. Cutting runners and thinning plants with a hoe is probably the safest and most accurate way, as well as the most economical method to employ.

Cultivating: Thorough tillage of the strawberry field is one of the most important factors in producing successful crops. The cultivation must be very thorough and should start soon after the plants are set. The soil must be mellow, moist, and absolutely free from weeds. There are five objects to be attained in cultivating the strawberry field: (1) to keep out weeds and grass, (2) to free plant food by increasing the chemical activity in the soil, (3) to increase the area upon which the roots can feed, (4) to keep the surface of the soil in condition so that it absorbs rains readily, and (5) to cause deeper rooting of the plants.

Tillage is important in conserving moisture. In the South very often fields are injured because of the lack of moisture. When the weeds are controlled, much has been accomplished toward successful strawberry production. Tillage should begin immediately after the plants are set and during the first year should be thorough in order to keep out the weeds. In some sections it may be necessary to go over the field at least every week or ten days with tillage implements, and several

times with hoes. The cultivation should be frequent until the mulch is applied. In certain sections of the South weeds grow during the winter, and it is necessary to keep them under control during this time. In most of the southern strawberry sections the fields are nearly flat, with the plants set on ridges or beds. It is necessary to keep the alley between these ridges or beds open to permit free drainage. Where mulching is not used so extensively, tillage should begin immediately after planting and continue each week or ten days until fall, or into the winter when the mulch is applied.

The implements used for tillage vary in different localities and depend upon the system of setting and upon soil conditions. . Wherever possible, tillage should be done with horse implements in order to reduce the expense. Usually one-horse cultivators are used. On the heavier soils, or where many weeds are present, a cultivator with from five to seven teeth is used. In lighter soils and where there are not so many weeds, a very narrow-tooth cultivator or some form of the spike-tooth harrow is good. Generally, it is necessary for the grower to have both types of implements. In some cases, usually under the hill system, garden wheel hoes are used. Whatever the type of implements used, there will need to be a certain amount of hand hoeing. The cultivation should be shallow.

Mulching: A mulch consists of a covering of material such as pine, wheat, rye, or oat straw that is put on the strawberry plants, and often between the rows. Pine straw is used in many southern strawberry sections. The mulching of strawberries in the South is considered by some to be an unnecessary and expensive operation, but most of the growers consider it a necessary part of the work in the production of a profitable crop. The purposes for which the mulch is applied are as follows: (1)

to keep the berries clean, (2) to conserve moisture, (3) to help keep down weeds, (4) to prevent heaving, (5) to lessen damage from cold, (6) to improve picking conditions, and (7) to prevent soil from baking.

When the mulching material is left between the rows and around the plants after having been raked off the plants in the spring, it keeps the fruit away from the ground and prevents it from becoming covered with sand during heavy rains that may come while the berries are ripening. Of the several advantages derived from mulching, this last named is very important.

In nearly all sections in the South where pine needles are used as a mulch, the material is collected during the winter and stacked along the sides of the field. The mulch is generally applied before the blossoms open. It is applied in such quantities that after settling it will be one to three inches deep.



Courtesy of George M. Darrow

PICKING STRAWBERRIES

Fertilizing: There is probably more variation in the use of fertilizer with strawberries than in any other practice. Much of the experimental evidence on the subject is conflicting. In the commercial production of the crop some growers use very liberal amounts, while others use none at all. In general, it may be said that fertilization of strawberries is very largely a local question, and where the fertilizer is needed the best formula to use will have to be determined by each individual grower for his own particular needs. The plant draws its food supply from near the surface, and this, together with the fact that it matures its crop within a short period of time, makes it require an abundant supply of readily available plant food in the surface soil. For this reason the use of commercial fertilizer is a very common practice in some of the southern strawberry sections where the soil is sandy and low in fertility. In those sections where soil is fertile, the physical condition is good, and humus is plentiful, it may not be necessary to use commercial fertilizer if frequent tillage is given. Most growers in commercial sections consider that nitrogenous fertilizer lessens the shipping quality of the berries, while phosphoric acid and potash make a firmer berry and one that stands shipment better. The amount and kind of fertilizer used by different growers varies with the location under which the plant food is to be supplied. As a rule, the lighter sandy soils of the Coastal Plain region need more potash and less phosphoric acid than do heavier types of soils in the more elevated sections of the South. In the strawberry district of North Carolina, in the Coastal Plain section, a fertilizer containing 4 percent nitrogen, 8 percent phosphoric acid, and 4 percent potash is commonly used. This is generally applied at the rate of from 1,200 to 2,000 pounds per acre, in two applications, one applica-

tion being made in July and the other in December.

Lime should not be used on strawberries except in very rare instances. If the soil is in such physical condition as to need lime, it is better to use it several years previously in connection with a leguminous crop. In many cases lime has been injurious to strawberry beds.

Renewing the Beds: In many sections of the South the beds are not renewed whatever the system used, because of the presence of nematodes, diseases, and insects.

Where the hill system is used, it is generally plowed up at the end of the first fruiting season. Where the matted-row system is used and nematodes and insects and diseases are not prevalent, the fields may be maintained until they are four to six years old, depending upon how long they may be kept in profitable condition. The limiting factors in the duration of the field are those of humus supply, nematodes, insects, diseases, and weeds. The first step in the operation of renewing consists in cutting the field with a mowing machine several weeks after the picking season is over. If many weevils have been present the field is generally mowed and burned over immediately after the crop is harvested. If insect and disease troubles have not been serious, the foliage and the mulch is generally plowed under. If the mulch is too heavy part of it is removed. In some cases, if the mulch is in good condition, it is raked up for use another year. In burning over the strawberry field, it is generally done when the wind will carry the fire down the rows. Precaution should be exercised not to burn over the field when the mulch and leaves are damp, or when the ground is very dry. After mowing and burning over the field, the plants are reduced in number by thinning and plowing. The width of the row that is left depends upon whether the variety makes run-

ner plants freely or not. Generally, the growers plow one side of the row and also the old plants in the middle. Young plants are left on the other side of the row. These are thinned by running a spike-tooth harrow across the rows several times. Plants with weak root systems are torn out by the process. If the plants are too thick after harrowing, they are thinned with a hoe. The width of the row is thinned to 8 to 15 inches, with the plants about 10 inches apart in the row. In some sections the rows are plowed along one side, removing about half of the row and leaving the remaining plants to set runners in the alleys. In the following year the other half of the old row is plowed up. By this method, in the third year the alleys are where the rows were at first.

Job 5—Controlling Strawberry Insects and Diseases

The principal insect enemies of the strawberry in the South are the strawberry root louse, the strawberry weevil, and white grubs.

White Grubs.—White grubs are largely what are known as May beetles or June bugs. They are frequently abundant in sod land where the eggs are commonly laid. If strawberries are planted on land infested with large numbers of these insects, a heavy loss of plants on account of the roots being eaten by the grubs may be expected. The white grubs remain in the soil for about two years. In controlling this trouble the most satisfactory method is a preventive one. Sod lands should be avoided for planting strawberries. Sod land should be in a cultivated crop for one or two years before planting to strawberries.

Strawberry Weevil.—This is a very serious pest during some seasons. It is a snout beetle about one-

tenth of an inch in length and varies in color from black to reddish brown. It hibernates in the adult stage under any convenient protection. In the spring the beetles visit the strawberry field just before blossoming and feed on the developing pollen. Eggs are deposited inside the blossom bud and then the stems are girdled so that the bud breaks off. In controlling this insect there are two avenues of attack. Everything should be done to destroy all possible winter quarters. The beds should not be planted near woods or other protection, and all trash about the beds should be destroyed. The other method of control is to use the pistillate types or varieties. This is not practical in cases where special standard varieties are produced for market, but it is practiced for home use.

Strawberry Root Louse.—This is the small, dark plant louse which infests roots, sucking the sap from them, and sometimes killing the plants in the field. The remedy is (1) avoid planting in ground known to be infested until it has been in some other crop for a year or two, (2) secure plants which are free from them, and (3) dip plants for a few minutes in a strong solution made by boiling tobacco stems or leaves in water.

Strawberry Diseases.—There are strawberry diseases which attack the leaves principally, there are other diseases which attack the root systems, while certain other diseases are more serious on the fruit itself. The principal leaf diseases are the leaf spot, leaf scorch, and white buds. Root knot is the principal root trouble with strawberries in the South. Those diseases attacking the fruit most are gray mold, tan-rot, leather-rot, hard-rot, and leak.

Leaf Spot.—This disease causes circular grayish-centered spots with dark red borders to be formed on

the leaves. It often causes serious weakening of the plant. A period of very humid weather with frequent showers brings about wide infection of the leaves. If this is followed by a dry spell the plants are greatly weakened.

Leaf Scorch.—This disease becomes a serious disease in the strawberry section of North Carolina and is probably prevalent in many other districts. Damage to the extent of 50 percent of the crop has occurred in some fields. This disease attacks not only the foliage but also the petioles and calyces. In its mature condition the disease forms large, irregular, purplish to reddish blotches which may run together and produce a general discoloration of the leaf. This disease is oftentimes confused with the common leaf spot which forms circular grayish-centered spots with dark red borders.

The leaf spot and leaf scorch may be controlled by spraying with bordeaux mixture. The first spraying is given in the spring when the leaves are about half grown. The additional sprays are given as often as necessary to keep the foliage covered until the first berries are about half grown. If two additional applications in late summer are given, much better control is secured.

The grower should determine whether the injury is sufficient to warrant the cost of spraying.

White Buds.—Plants affected with this disease do not bear fruit. The cause of the disease is not known. Plants that are affected with the trouble may be distinguished by the twisting of the central and younger leaves. This is often accomplished with a slight yellowing of the diseased leaves. No central bud develops in these plants. In controlling this trouble all suspected plants should be discarded and only healthy ones used.

Root Knot.—This is probably the most serious trouble with which southern strawberries have to contend. It is caused by nematodes. The nematode is not a true insect but is a very minute, wormlike organism, about one-sixteenth to one-twentieth inch in length. While the roots may be affected with no prominent enlargements on them, the nematode generally penetrates the small roots of the plant and produces numerous knotlike swellings. These interfere with the passage of water through the roots, causing the plants to become weakened and dry. Nematodes cause more severe damage on sandy soils than in heavier soils. In nematode sections land known to be free from nematode should be selected for strawberries. In many cases, however, this is not possible. It is then necessary to free the land from them. This is generally accomplished by the starvation process in two or three years. The land is given clean cultivation and left bare of all vegetation, or else crops that are immune to nematodes are grown during the period. If the nematode resistant crops are used, Iron and Brabham cowpeas, velvet beans, peanuts, corn, oats, and Laredo soybeans should be planted.

Gray Mold.—The most widely distributed fruit rot of strawberries is that caused by mold. It is first observed as a light brown spot. The rot generally starts in that part of the berry which is next to the ground. When the berry is entirely rotten it dries out and becomes firm. In this condition it is of a uniform brown color throughout. At this stage the fruit becomes covered by a dusty appearing fungus growth. Berries showing signs of this disease should be discarded during picking and packing.

Tan-Rot.—This disease is a menace during rainy seasons in many commercial strawberry districts. It

may be readily identified by the characteristic of the rotten portion forming in the shape of a cone which can be easily removed intact with the point of a knife. The disease attacks both green and ripe berries and forms slightly sunken, tan-colored areas.

Leather-Rot.—Leather-rot is easily distinguished from other fruit rots by the bitter taste of the berries which are affected. Partly colored berries have light brown spots which shade off into purple and then to the natural color of the berry.

Hard-Rot.—This disease produces a hard brown rot and generally causes the berries to be one-sided. The spot is separated from the remainder of the berry by a distinct line.

Leak.—Leak is the most destructive rot of strawberries in transit. This disease is caused by the common black mold. It enters the berries through wounds and makes very little growth at temperatures below 50° F.

The rots which attack the berries in the fields are most severe during wet weather. Fields that are well drained and free from weeds show less susceptibility to these rots than poorly drained fields and those with weeds. The rots which injure the berry in transit are generally held in check by the low temperature of the refrigerator cars. Much of this trouble may be prevented by careful handling, in picking, and packing.

Dwarf or Crimp.—Dwarf or crimp of strawberries may be caused by either of two related species of nematodes which attack the unfolding leaf buds of the plant. The small nematode worms can be seen only by the aid of a magnifying glass. The organisms live in the small leaf buds of the plant and cause a stunted or dwarfed condition, or death of the plant. One form of the dis-

ease develops in the spring and the other in late summer or fall. There is no very practical remedy other than to purchase carefully inspected plants from reliable growers.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. In preparing the land for strawberries the grower will need to consider what factors?
2. What types and conditions of soils require several years previous preparation before setting to strawberries?
3. How should sod land be handled before planting to strawberries?
4. Are nematodes serious in your community?
5. How is nematode infested land freed for setting to strawberries?
6. How long does the treatment take?
7. What crops are used in connection with freeing land from nematodes?
8. Discuss the relation of fertility and humus content of the soil in relation to strawberry growing.
9. Describe the actual preparation of the land before setting to strawberries.
10. Are strawberries set on ridges, in small beds, or on level ground in your community?
11. Are strawberries grown in rotation with other crops in your community?
12. What are the principles which should govern the grower in deciding upon a rotation?
13. What decisions will the prospective strawberry grower need to meet in setting out the plants?
14. When are strawberry plants usually set in your section?
15. When are strawberry plants set in the more important commercial districts of the South?
16. What systems are commonly used in the South for handling strawberry fields?

17. In what commercial districts in the South are these systems most generally used?
18. What system or systems are used in your community?
19. What variations of the hill system are used?
20. Describe the hill system.
21. Describe the variations of the matted-row system.
22. Describe the establishment of the matted-row system.
23. How are strawberry plants prepared for setting?
24. What are some of the important considerations in securing a good stand in setting strawberries?
25. What implements or tools are used in setting strawberry plants?
26. Describe the use of two of these tools in setting plants.
27. Is it advisable to remove flower stems from the strawberry plant when establishing a field?
28. What is the principal factor in determining the type of management given to the runners?
29. What objects are to be attained in cultivating the strawberry field?
30. Discuss tillage in relation to the management of the strawberry field.
31. What materials are used for mulching in your section?
32. What formulas and amounts of fertilizer are used by growers in your community?
33. Should lime be used on a strawberry field?
34. Are beds renewed in your community or new beds planted?
35. What are the principal insect pests and diseases of strawberries and how is each controlled?

SUGGESTED EXERCISES

1. Visit strawberry fields in the community to observe systems of training used, evidence of disease and insect injury, and methods of management.
2. Make a study of the practice of the strawberry growers of the community relative to time of planting, distance of planting, kind and amount of fertilizer applied, kind of mulch used, methods of disease and insect pest control, and method of cultivation.

CHAPTER XXXV

STRAWBERRIES—PICKING AND MARKETING

Job 6—Picking and Packing Strawberries

Picking is one of the most important considerations in the whole business of strawberry growing. One may have given the bed good cultivation and have a fine crop, but if the fruit is not properly picked and packed the grower will not receive satisfactory returns.

It is somewhat difficult to establish a standard for the degree of ripeness at which strawberries should be picked and to get the pickers to follow this standard. The degree of ripeness depends on the distance to market. As the distance to market increases the degree of ripeness decreases. If to be shipped to a distant market, the berries should be picked when about three-fourths ripe as they will ripen in transit. They should be picked under-ripe rather than over-ripe for distant shipping. For local markets, however, when the berries are eaten the same day that they are harvested, they should be allowed to become fully ripe.

Managing Pickers.—The management of pickers is an important consideration for strawberry growers. Every preparation should be made beforehand so that the work of picking will be facilitated. The pickers should be organized and coached so that they work according to the system adopted by the growers. In some cases growers give the pickers a set of printed instructions in addition to oral coaching.

The points in connection with picking that should be emphasized are (1) always pick with piece of the stem

at least one-fourth of an inch long; (2) the row should be picked clean. Those berries that are not desirable for marketing should be picked off and dropped on the ground; (3) the berries should be handled carefully so as to avoid bruising. The picker should not hold berries in the hand but put them immediately in the boxes. The boxes should be filled full. The pickers should be



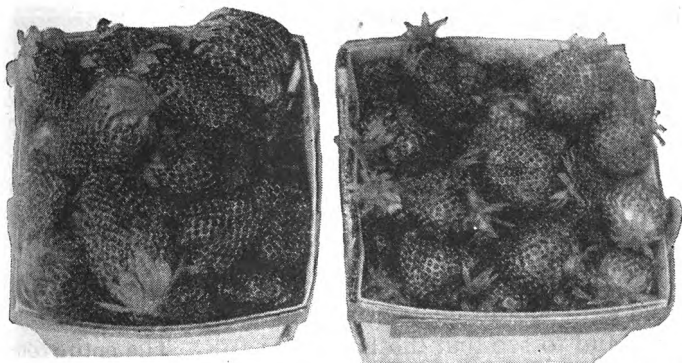
Courtesy of George M. Darrow

TWO SIX-QUART CARRIERS COMMONLY USED IN PICKING BERRIES.
THEY ARE CHEAPLY MADE AND CONVENIENT TO USE

trained to grade as much as possible while picking, putting the best berries in certain boxes and the poorer ones in others; (4) pick every day after the season is started; (5) pick when dry. If the weather is rainy or there is much dew wait until the fruit dries off somewhat before picking. Most berries will not hold up in shipment and are certain to decay; and (6) do not expose to the sun. The berries should be kept as cool as possible. They should be brought to the packing shed as soon as picked, for they should never be allowed to stand in the sun.

It is better if each picker does not have over six quart

baskets in the field at a time. Each picker should be assigned to a row. Pickers should be instructed to pick the berries with stems one-half to three-fourths of an inch in length. Careful supervision should be given to see that all ripe fruit is picked each day and in a careful manner. In large operations this necessitates the employment of field bosses to supervise picking.



Courtesy of George M. Darrow

Left, A VERY LARGE STRAWBERRY VARIETY GROWN TO SOME EXTENT IN EASTERN NORTH CAROLINA; Right, BLAKEMORE, THE MOST WIDELY GROWN BERRY IN SOUTHERN STATES

The number of pickers required will vary from two to twelve per acre. Where the yields are small, two pickers to the acre are sufficient. In some fields at the height of the season, from eight to twelve pickers are required. On a field yielding fifty 32-quart crates to the acre, four or five pickers should take care of the crop.

Picking Equipment.—Each picker should have a carrier, which is a small tray with a handle for holding four or six quart baskets. Most growers use a tray holding six baskets; however, a few growers think that four-

basket carriers are desirable. In some fields the pickers are supplied with record cards so that the number of quarts that they pick each day is secured, and at the same time a check on the quality of the work of each picker is possible. Where a card system is used it is well to have cards in duplicate so that both the pickers and the foreman have a card. These cards are made up with numbers which are punched out with a punch when the berries are delivered to the field boss.

How to Grade.—Carefully trained pickers can do all the grading and sorting necessary as they gather the berries. This method of grading eliminates the necessity of rehandling the fruit after it has been brought to the packing shed. Some growers regrade the berries at the packing shed. This will depend upon the type of pickers and the quality of the berries. In grading at the shed care should be exercised to avoid bruising the berries, and to see that the boxes are full. The entire contents of the basket should be of the same grade as those placed on top. Small and inferior berries should not be scattered throughout the baskets, but the top layer should be representative of the entire contents.

How to Pack.—Strawberries are usually packed in crates holding 24 to 32 quart baskets. The berries should be cool and dry before being placed in the crate. Heat and moisture promote decay. No strawberry grower's equipment is complete without a conveniently located packing shed. A building of this kind need not be made of expensive material, but the construction should be such as to allow a free circulation of air and at the same time shade the berries. It is important to see that the boxes in the crates are full for there is some settling of the berries in shipment.



Courtesy of George M. Darrow

INTERIOR VIEW OF A PACKING SHED

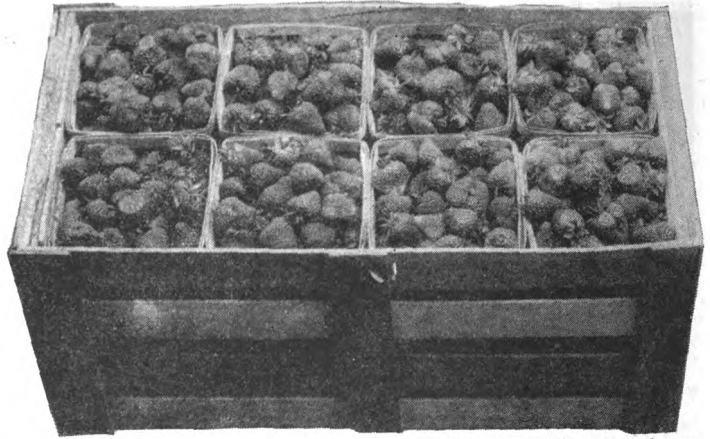
Job 7—Marketing Strawberries

The job of marketing strawberries is, perhaps, the most important part of the entire strawberry business. The raising of berries requires a great deal of labor and considerable knowledge on the part of the grower, and it requires experience and carefulness to properly grade and pack the berries for market. Individuals may make a thorough success in raising, grading, and packing the berries, and yet fail entirely in marketing them. The job of marketing strawberries involves the following decisions on the part of the grower: (1) how to sell, (2) where to sell, and (3) whether or not to use shipping point inspection.

How to Sell.—Growers may sell in any one of the following ways: (1) cooperatively, (2) load and ship

cooperatively, (3) ship on consignment individually, (4) to local buyers, (5) to cash buyers, (6) at auction, and (7) to preserving plants.

Cooperative marketing has been more widely practiced and has probably been more successful with strawberries than with any of the deciduous fruits. Where cooperation has been successful with strawberries, it has



Courtesy of George M. Darrow

A CRATE OF WELL-GROWN BERRIES WHICH DO NOT NEED TO BE GRADED FOR MARKET

been the result largely of necessity and has come about through dissatisfaction on the part of the growers with existing conditions. A great many growers will not have the opportunity of selling strawberries cooperatively because of the absence of such organizations in their immediate section. If there are no cooperative organizations in their immediate section, local growers might consider the advisability of forming an organization. The day of the individual strawberry grower operating as an individual is fast passing, and the necessity for group action is increasing.

There are two types of selling organizations. In one type the fruit of each individual member is kept separately from that of all others. It is sold separately, though it may be shipped in the same car with other lots. In the other type of selling organization, all of the berries of the same variety and grade are pooled and sold under the brand of the association. The returns are pro-rated to the grower according to the number of packages in the pool. Those organizations which use pools are examples of the higher type of cooperation. The pool may be daily, weekly, or seasonal.

The cooperative marketing of strawberries has probably had its most extensive development in the Louisiana and southwestern Missouri districts. Here many organizations have developed, and nearly every grower belongs to some organization. In certain districts the local associations have federated into a larger organization. This has taken place in the Missouri section where the Ozark Fruit Growers' Association has been formed. Over 50 associations are federated in this organization. Cooperative marketing of strawberries in the Ozark district in Missouri has been satisfactory in performing a service for its members. It has resulted in a better standardization of the product. The berries are generally hauled to a loading shed on wagons equipped with springs so as to reduce the amount of bruising. The crates are marked with the grower's name and the name of the local association, and each crate is inspected by an inspector before it is placed in the car. After the cars are loaded by the associations at the various shipping points, the car numbers and a description of the contents are phoned to the offices of the selling organizations at Monett, Missouri. Here they are offered for sale at the auction where there are more than 20 buyers present. The cost of loading and selling is approxi-

mately 5 percent of the f. o. b. price of the berries.

All associations do not perform the same functions for their members. Some associations practically pay cash for the berries delivered, others load the cars and consign them to various firms in the market as desig-



Courtesy of George M. Darrow

AN AUCTION MARKET AT WALLACE, NORTH CAROLINA, SHOWING LOADS OF BERRIES BEING DRIVEN UP TO BOTH SIDES OF THE AUCTION MARKET

nated by the owners, while still others take the entire responsibility for marketing the crop.

In many sections these organizations have been of great value, and as they are perfected, the results are more satisfactory. In some cases they have relieved the grower of most of the details of marketing, have undertaken the work of securing supplies, and have secured labor for picking during the harvest season.

The essentials to success in a strawberry cooperative marketing organization may be summarized as follows:

(1) there must be a large quantity of berries of similar variety and grade, (2) the grading and packing must be under the supervision of the association, (3) the members must sign a binding contract to ship their berries through the association, and (4) the association must be organized on the one-man-one-vote principle.

In some sections the growers do not sell cooperatively, but different individuals arrange among themselves to load and ship cars together so that they may take advantage of reduced freight rates secured by carlot shipment. In many cases this is the forerunner of more extensive cooperation.

In sections where there are no organizations, many growers ship individually on consignment to commission men in northern markets. Selling on consignment has met with much criticism, but many growers have practiced it with entire satisfaction. A grower should carefully investigate the standing of the firm with which he expects to do business. In many sections the berries are sold to local or cash buyers. This method has the advantage in that the growers receive money immediately. It is a very popular method in the North Carolina berry district, but it has been criticized by some in that when the market is well supplied, berries do not bring as much as when shipped.

In certain sections of the South, especially in certain parts of Missouri and North Carolina, berries are sold at auction. Daily auctions are held and buyers from many markets buy the fruit. In some sections there is a demand for the berries from preserving factories where different products are made, such as jams and flavorings.

Where to Sell.—If the grower is a commercial producer, he will either sell locally or ship to one of the

larger markets. This will be determined very largely by comparison of the local price and the distant market price. Where the grower is producing only for local market, he will of necessity have to sell his product to local consumers, or to consumers who come direct to the fruit farm.

Shipping Point Inspection.—If the fruit is to be shipped to a distant market and shipping point inspection is available, it will generally pay the grower to use it. The inspection is of value to the grower in establishing the condition of his produce according to grade, and the certificate received is *prima facie* evidence in court of the grade. If the crop is to be sold to local buyers, it is not so essential to have shipping point inspection, but even here in some instances it will be of value.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. What decisions are required on the part of the grower in picking and packing strawberries?
2. What determines the degree of ripeness in picking strawberries?
3. How should they be picked for shipment?
4. How should they be picked for local market?
5. What are the points in connection with picking that should be emphasized?
6. What picking equipment does each picker have?
7. How are strawberries graded?
8. In what sized crates are strawberries packed?
9. What size of crate is used in your community?
10. What are the main considerations in building a packing shed?

11. In what different ways may growers sell the strawberry crop?
12. Discuss cooperative marketing of strawberries.
13. How do the growers in your community dispose of the crop?
14. If there are no cooperative marketing organizations in your community, do you think it would be advisable for the growers to organize?
15. What are the essentials to success in a strawberry cooperative marketing organization?
16. What determines where the grower shall sell his crop?
17. Discuss shipping point inspection in relation to strawberry marketing.
18. Do the growers in your community use shipping point inspection?

SUGGESTED EXERCISES

1. Visit the local strawberry fields and make a survey to determine the methods of picking and packing and by what methods the strawberries are sold in your community.
2. Write to the United States Department of Agriculture, Washington, D. C., for copies of market reports for the marketing of strawberries.
3. Write the United States Department of Agriculture, Washington, D. C., for United States grades for strawberries.
4. If there are any strawberry cooperative marketing organizations in your community, determine how they are organized and how they function.
5. Determine how many growers in your community use shipping point inspection.

SEASONAL OPERATIONS WITH STRAWBERRIES

January, February, and March

Secure plants for planting. Set plants. Set out propagating beds. Cut runners from plants in the hill system. Remove blossoms from plants set in the fall and winter. Cultivate. Apply mulch. Clean around field to destroy strawberry weevil.

If leaf spot or leaf scorch is serious, spray with bordeaux mixture. Make arrangements for pickers and secure supplies. Harvest early berries.

April, May, and June

Cultivate. Cut runners from plants in the hill system. Remove blossoms from plants set in the early spring. Where leaf spot and leaf scorch are serious, spray with bordeaux mixture. Harvest the market crop. Plow under old beds and renew beds where matted-row system is used and plants are free from disease.

July, August, and September

Cultivate. Cut runners from plants in hill system. Apply fertilizer. Set out runner plants. Where leaf spot and leaf scorch are severe, spray with bordeaux mixture.

October, November, and December

Set plants. Apply fertilizer. Secure mulching material. Plow ground for spring setting.

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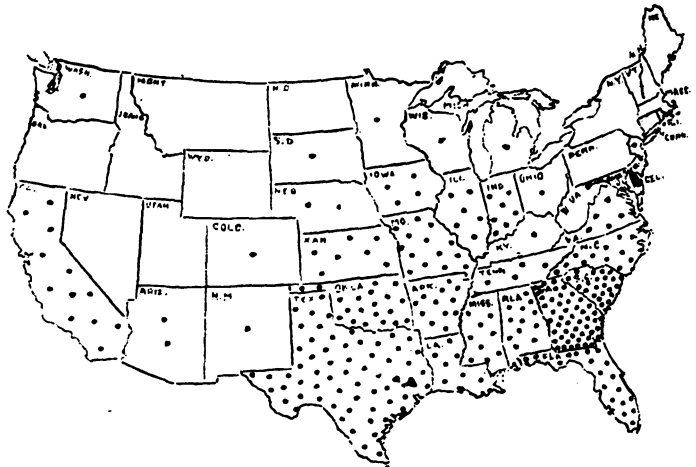
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CHAPTER XXXVI

MELONS—GROWING THE CROP

Job 1—Selecting the Land for Watermelons

Before making plans to plant a crop of watermelons the grower should decide whether they are to be grown for (1) home use, (2) local market, or (3) shipping



MELON PRODUCTION IN THE UNITED STATES

Each dot represents 1,000 acres.

in carlots. The varieties grown and the acreage to be put into melons will depend upon this decision. But in all cases, the grower should know the cultural requirements of the crop in order to grow it successfully. If he decides to grow watermelons on a commercial scale he should also study market conditions and the competi-

tion he will meet in the markets from growers in other states as well as in his own.

Where the Watermelon is Grown.—The watermelon is a native of Africa, though it is now grown in almost all temperate climates of the world. It is grown in small patches for home use all over the United States; however, less than half the states produce watermelons on a commercial scale.

The chief watermelon producing states with their 1939 acreage, carlot shipments, and value of shipments are shown in the following table:*

State	Number of Acres Planted	Number Cars Shipped	Total Value in Dollars
Georgia.....	62,600	3,858	\$482,250.00
Texas.....	40,000	574	103,320.00
South Carolina.....	25,500	2,734	273,400.00
Florida.....	21,700	3,428	617,040.00
California.....	15,850	2,972	359,417.00
Alabama.....	15,400	591	44,325.00
Oklahoma.....	14,500	156	17,160.00
Missouri.....	13,000	1,365	95,555.00
North Carolina.....	12,000	1,006	125,750.00
Mississippi.....	9,600	658	59,220.00
Indiana.....	8,600	4	400.00
Illinois.....	6,900	58	5,220.00
Arkansas.....	6,000	124	7,440.00
Virginia.....	5,400	677	60,930.00
Louisiana.....	5,000	307	43,901.00
Maryland.....	3,700	248	22,320.00
Delaware.....	3,300	46	3,680.00
Iowa.....	2,300	140	12,600.00
Arizona.....	2,000	15	2,175.00
Washington.....	880	55	5,500.00
Oregon.....	750	4	700.00

In some of the states since a very large percentage of the melons grown are consumed at home and sold in the local markets, they are not reported along with the carload shipments. Consequently, the total yields of the

* From 1940 Yearbook, United States Department of Agriculture.

several states are considerably larger than the figures in the table would indicate.

Soil Requirements of Watermelons.—The fertile sandy loam soils common in the Coastal Plain areas and in the broad river valleys are best adapted to the growing of watermelons.

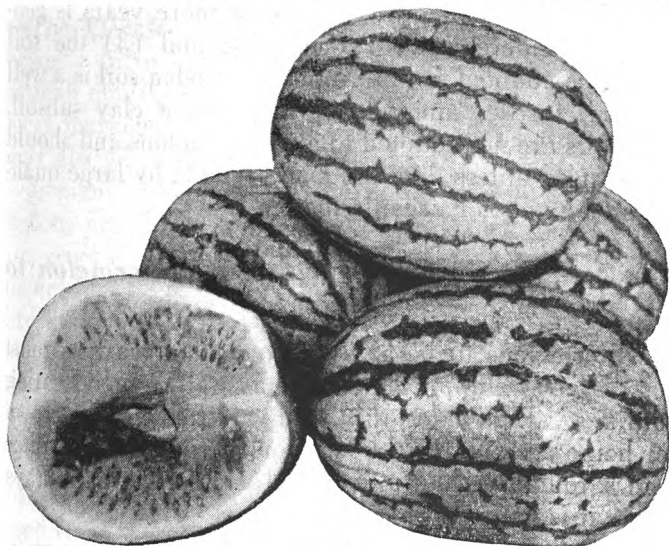
Watermelons for Home Use and the Local Market.—The grower can easily estimate the needs of his family and the other occupants of the farm for whom the melons are to be grown. From one-fourth to one acre of land will usually produce enough watermelons for the family and some for the tenants of the farm.

The additional area which should be planted for the local market will depend upon the demand for watermelons on the markets easily accessible to the grower. A very careful study should be made of the needs of the nearby markets and the probable supply for these markets from the outlying districts before any considerable increased area is planted for sale direct to the consumer; for it frequently happens that the small local markets become glutted and will not consume additional supplies of melons at any price.

Watermelons for Shipping to Distant Markets.—The maximum amount of land which should be planted to watermelons for shipping to distant markets will depend upon the supply of labor, capital, nearness to shipping station, and adaptability of soil. The grower should plant enough land, however, to enable him to make carload shipments, rather than to attempt to ship in the same car with some other grower.

An acre of land may be expected to produce from 300 to 500 marketable melons. Melons ranging from 18 to 36 pounds in weight are shipped, though there is

little demand for the smaller sizes. It requires from 700 to 1,000 melons, ranging in size from 28 to 36 pounds, to make a carload; while it requires about 1,600 of the 18-pound size to fill a car. It takes from two to three acres to produce a car of watermelons. However, since the fields are picked over from two to three times, the grower should plant a sufficient area to get at least



Courtesy of Joseph Harris Company, Inc.

DIXIE QUEEN WATERMELONS

a car of merchantable melons at each harvest to enable him to ship in carlots. It is, therefore, not a safe practice to plant less than ten acres of land to one variety where the grower desires to ship to distant markets in carload lots.

Land on the Farm Suitable for Watermelons.—

In selecting the part of the farm that would be suitable for growing melons to ship, the following points should

be considered: (1) the land should be accessible to the shipping station so that the trucks would have no difficulty in hauling the melons to the shipping point; (2) the land should be free from nematodes or diseases attacking watermelons. Land that has recently been cleared of forests, "new ground," as it is called, and also land that has grown no watermelons or other crops susceptible to nematodes for five or more years is generally considered safe for melons; and (3) the soil should be adapted to watermelons. Such a soil is a well drained, fertile, sandy loam soil with a clay subsoil. Stiff soils are not adapted to growing melons and should not be used unless they are made friable by large quantities of humus or organic matter.

Job 2—Selecting the Variety of Watermelon to Grow

Watermelons to be shipped to distant markets must possess good shipping qualities as well as good eating qualities. The tender, thin rind varieties may be grown for home use and for the local markets. A long, rather than a round, melon is desired for shipping as it stays where it is placed in the car.

Varieties for Shipping.—Dixie Queen is a leading shipping variety of watermelon grown in the Southeastern United States. This variety is a round melon with gray green stripes and red flesh. It is smaller than the Tom Watson though it is of better quality and is replacing the Watson in many of the commercial watermelon growing areas.

The Georgia Wilt Resistant variety, originated by the Georgia Experiment Station, is a promising new variety. It ships well. See illustrations on pages 454 and 455. The Irish Grey and Thurmond Grey were at

one time prominent shipping varieties but are now being replaced by such varieties as Hawksbury and Leesburg principally because the latter are resistant to the wilt disease and can be grown rather successfully on wilt-infested soil, a condition that prevails in most melon growing areas.

Varieties for Home Use and for Local Markets.

—The Kleckley Sweet, Florida Favorite, and Pride of Georgia (also known as Stone Mountain) are varieties of high quality extensively grown for home use and for local markets. The shipping varieties already named may also be used for this purpose.

In many sections of the South, good varieties of watermelons are found which have been grown and selected for generations, but which have never received varietal names nor been handled by the seed trade. The seeds are saved and passed from neighbor to neighbor under some local varietal name which is little known outside the community. Many of these selections are of excellent quality and are well worth growing.

Where to Get Watermelon Seed.—When a grower has once obtained a desirable variety he can save the seed from his own fields. However, in the beginning he must get them from some outside source. Frequently, some grower of the community makes a practice of saving seeds from selected watermelons of a good variety. It is well to secure seed from such growers where they have the desired variety. Some of the commercial seedmen have their watermelon seed grown under the strict supervision of competent growers and can be depended upon to supply good varieties true to type. It takes only a pound of seed to plant an acre, so that the grower can well afford to pay a good price for seed of the right quality.

Job 3—Preparing and Fertilizing the Soil for Watermelons

In the late fall or during the winter, land containing velvet bean vines or other coarse organic matter should be turned. This is done in order that vegetable matter will have time to decay partially before the watermelons are planted the following spring. The land should be turned to the depth of from seven to eight inches with any convenient turn plow that is commonly used in the preparation of land for planting corn or cotton. The following spring the land should be harrowed with a disk harrow several days before the melons are planted. Large roots and other coarse material commonly found on newly cleared land after it is plowed should be picked up and either hauled out or burned.

Laying off the Rows.—Most growers follow the practice of laying off the rows in checks so that the watermelons can be cultivated in two different directions. In checking the land, the rows are laid off ten feet apart each way. Some growers space them ten by twelve while others check them off twelve feet apart each way. Occasionally a grower checks them eight by ten feet apart. However, this is not the common practice. Where the land is rolling, it is best to lay off the rows with the contour of the hill and cultivate in only one direction so as to prevent excessive washing of the soil.

The rows in the direction that most of the cultivating is to be done are commonly laid off with a large plow, called a middle burster, or some other plow which will leave a deep open furrow. The cross furrows are made with the same plow if the fertilizers are to be applied in two directions. However, the cross furrows are generally checked off with a smaller plow.

Fertilizers for Watermelons.—Stable manure is an excellent fertilizer for watermelons. The grower should be careful, however, that hay from watermelon fields was not used as feed for the animals producing the manure, as such hay is a common means of spreading to the field serious watermelon diseases through the manure.

If stable manure is plentiful it should be applied continuously in the deep furrows made in laying off the rows. From eight to ten tons to the acre should be used. However, if stable manure is scarce, which is usually the case, only about a peck or one forkful is put into the deep furrow, half of it on each side of the intersection of the two furrows, allowing a bare space of about ten inches at the hill where the seeds are to be planted. This practice should be followed in applying both commercial fertilizers and stable manure, as the viability or germinating powers of seeds are often lessened if the seeds are planted in close contact with the fertilizers.

New ground contains considerable quantities of organic matter and is less benefited by stable manure than lands which have been cultivated for several years.

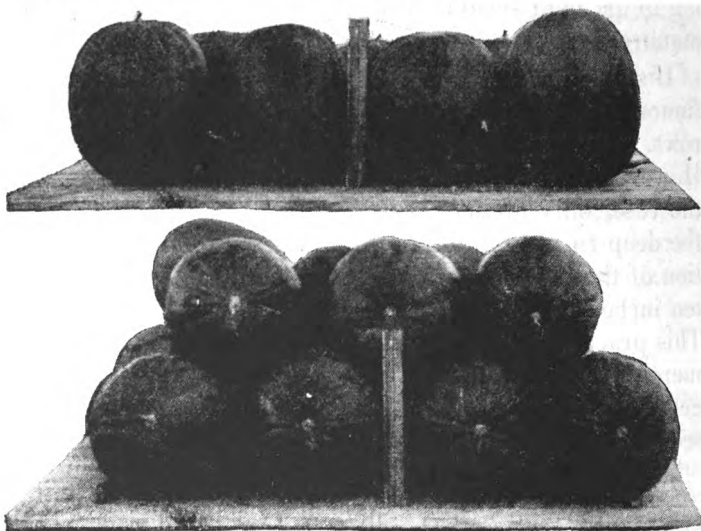
Commercial fertilizers may be used with the stable manure or they may be used alone, if a supply of stable manure is not available.

A mixture containing from 4 to 5 percent nitrogen, 8 to 10 percent phosphoric acid, and 4 to 5 percent potash is satisfactory for most sandy loam soils. This should be applied just before the seeds are planted. Methods of making up fertilizer mixtures will be found by referring to the chapter which deals with fertilizing peach trees.

The amounts of fertilizers used for watermelons varies from 300 to 1,000 pounds to the acre. Upland sandy

soil, medium in fertility, requires more fertilizers than the fertile sandy loams of river bottoms.

Land which has received a moderate application of stable manure should have an additional application of about 300 pounds to the acre of commercial fertilizers.



RIBS ON GEORGIA WILT-RESISTANT WATERMELON ARE NOTICEABLE ON THE STEM END, BUT THE BALANCE OF THE MELON IS COMPARATIVELY SMOOTH

Where no stable manure is used a good practice is to use from 400 to 500 pounds of the fertilizer in the drill before the seed are planted; and then apply as a side dressing, when the vines are about 18 inches long, from 75 to 100 pounds to the acre of a quickly available fertilizer such as sulphate of ammonia or nitrate of soda.

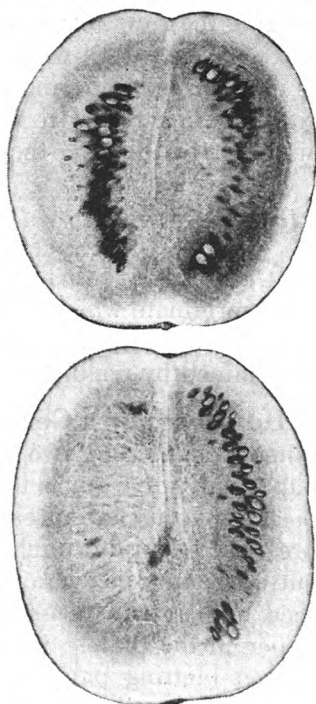
The fertilizer should be mixed with the soil by running a plow through the furrows after it is put down.

The fertilizers used for a side dressing may be strewn on the surface of the soil about twelve inches from the

plants and worked into the soil with a cultivator. Care should be taken not to put the fertilizer used as a side dressing on the leaves of the vines.

Influence of Fertilizers on Texture and Quality of Watermelons.—It is the belief in some sections that quickly available nitrogenous fertilizers cause melons to ripen unevenly through the heart, a defect called "white heart." Some watermelon buyers contend also that such fertilizers produce melons which ship poorly. However, experiments conducted by the Georgia Experiment Station indicate that the kind of fertilizer mixture used has no appreciable influence on the quality or texture of the watermelon. There is little doubt but that the weather conditions during the growing period of the watermelons influence the texture and quality of the melon more than the kinds of fertilizers applied.

The watermelon is an acid tolerant plant, and as a rule does not respond to lime. In fact, a liberal application of lime to the soil is likely to reduce the yield



HALVES OF TWO MELONS OF THE GEORGIA WILT-RESISTANT WATERMELON SHOWING EXTREMES OF VARIATION IN SHAPE

Rind of melon on bottom is somewhat thicker than the average for the variety.

of watermelons. Soils when first cleared from the forest are slightly acid and are well suited usually for growing watermelons.

How to Ridge the Land for Planting Watermelons.—After the land has been well broken and harrowed before the rows are laid off, it is ready for ridging the rows preparatory to planting the seed. This work may be done with an ordinary turn plow such as is used in bedding land for planting cotton. Four furrows to each row will make a broad, flat-topped ridge suitable for planting the seed.

Job 4—Planting and Cultivating Watermelons

It is important that a high percentage of watermelon seed germinate when planted, in order to insure a good stand of plants. The viability of the seed can best be determined by making a germination test.

How to Make a Germination Test.—Two common dinner plates and two pieces of clean thick blotting paper will serve for making the test. Wet one piece of the blotting paper, spread it over one of the plates and press the paper down into the bottom of the plate. Count out one hundred average specimens of the watermelon seed and spread them on top of the sheet of blotting paper in the plate. Cover the seed with another sheet of wet blotting paper and then invert the other plate over the first plate, covering the two sheets of blotting paper containing the seed. Set the plates in a warm room with a temperature of about 70° or 75° F. Keep the blotting paper fully moist but do not allow water to remain in the bottom of the lower plate. Count the seed as they germinate and remove them from the plate. The test should be completed in from ten days to two weeks.

At least 90 percent of good watermelon seed should germinate.

How to Treat Seed Against Disease Spores.—Watermelon seed are treated in order to kill the spores of injurious diseases, such as anthracnose and wilt that may be attached to the surface of the seed and thus prevent the early infection of the young seedlings. The process is so simple and inexpensive that the commercial grower cannot afford to plant seed that have not been treated.

In a wooden or enameled vessel prepare a solution of one-eighth ounce of corrosive sublimate (bichloride of mercury) in one gallon of water. After the chemical has dissolved, pour in the seed and stir for five minutes. Then pour off the solution and wash the seed thoroughly in clean water. If the seed cannot be planted at once they should be spread out and dried quickly, and then stored in a clean bag. Corrosive sublimate is a violent poison. Precautions should be taken, therefore, to prevent animals from drinking the solution.

Planting the Seed.—After the danger of spring frosts is past and the soil has become warm, which is about the time cotton is usually planted, the seed should be planted. If possible, select a time when there is a liberal amount of moisture in the soil. If the soil is wet it will pack on the seed and if it is too dry the seed will not germinate, or, if they germinate, the young plants will die soon afterwards.

Knock off the surface of the soil with a hoe down to the moist mellow soil. Scatter ten to fifteen seed over a surface of about a square foot at the intersection of the furrows. Push each seed separately into the soil about an inch deep, and smooth the surface soil over with a hoe or the foot, care being taken that the finger

holes are filled with soil. Planted in this way, each plant comes up independently of the others. As a result, the time lost in planting the seed so carefully will be gained in thinning, for it is an easy matter to chop out the poorest plants without interfering with the others.

Growers sometimes plant seed twice in order to increase their chances of producing early melons. Seed are planted about ten days or two weeks earlier than is considered safe, usually, on account of spring frosts. Plantings are made again at the regular time and only about one foot from the first planting. If spring opens earlier than usual the first planting produces the crop. But if frost catches these early plants the late ones are relied upon for the harvest.

It is better to plant a sufficient quantity of seed to avoid replanting if possible. About one pound of seed to the acre is a liberal allowance. Replants cause irregularities in cultivation and often produce poor melons. The plants should be up in about ten days after planting.

Thinning the Plants. — The plants should be thinned as soon as they are well up or about the time the second pair of leaves start growth. It is best to leave three plants to the hill the first time the field is gone over. About ten days later or when the young plants are well established they are again thinned to only one in a hill. A few of the growers producing watermelons for home use leave two plants to a hill. By this method a larger number of melons are produced, but they are smaller in size. Most commercial growers have only one plant to the hill as this induces larger melons which are in demand on the markets.

Cultivating Watermelons. — Cultivating should begin soon after the plants appear. Watermelon vines

grow rapidly and delayed attention may cause serious loss. The time and character of the cultivation is determined by the soil and weather conditions. The surface soil should be kept fresh and free from weeds and grass.

One hoeing at least will be needed. Frequent plowing is necessary and is done usually in two directions with a two-horse cultivator or with single cultivators, according to the equipment of the grower.

Some growers follow the practice of "laying by" or stopping the cultivation of watermelons soon after the vines begin to run. Others prefer to cultivate them until the young melons reach a diameter of from two to three inches.

Planting Legumes in Watermelon Fields.—Where the cultivation is stopped early cowpeas, velvet beans, or soybeans are usually sown broadcast over the land at the last cultivation. But where the cultivation is continued until the young melons appear it is customary to plant two rows of cowpeas between each two rows of melons ten days or two weeks before the melons are laid by. In this way the peas or beans will receive one or two cultivations with the melons.

The grower who desires to give late cultivations without interference, may delay planting the peas or beans until the last plowing. At this time the peas or beans are sown broadcast.

Thinning the Fruit.—The general practice of commercial growers is to thin the melons when they are from four to six inches long, leaving only two melons to the vine. In some instances the grower may deem it advisable to leave as many as three melons on extra strong and vigorous vines. The two or three best shaped and most promising melons, free of disease and other defects, are left, while all others are pulled or cut off. In

thinning, the melons should be removed with the least possible disturbance to the vine. Some growers use a sharp blade made from a piece of an old saw riveted in the end of a stick about a yard long. The stems of the young melons are cut with this blade and the melons allowed to remain where they are.

The grower should remember that the smaller the number of melons left on the vine, the larger the melons will grow. Large melons bring better prices and are far more profitable than either small or medium sized melons.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Before making plans for his watermelon crop what decisions should the grower make? Why?
2. Where are watermelons grown today? How does your state rank as a producer of watermelons?
3. What soil type is best suited to watermelons?
4. How much land should be planted to watermelons for home use on a farm?
5. How many melons will an acre of land produce?
6. How many melons does it take to make a carload?
7. What is the minimum number of acres to plant to one variety if the grower desires to ship in carlots?
8. What points should be considered in selecting land on the farm for watermelons that are to be shipped?
9. What is the difference in the type of a melon suited for home use and one suited for shipping?
10. Name a melon for home use; for shipping.
11. What variety of watermelon is grown in your neighborhood?
12. Where do you get your watermelon seed?
13. What preparation should the land have for watermelons?
14. How are the rows laid off?

15. If stable manure is used for a fertilizer what precautions should be taken?
16. How is the stable manure applied and in what quantities?
17. What should be the analysis of commercial fertilizers for this crop and when should it be applied?
18. How much fertilizer should be used?
19. In applying a side dressing of fertilizer how far should it be put from the plants? Why?
20. How are the rows ridged for planting?
21. How should the seed be treated against disease spores?
22. Where should the seed be planted?
23. Give the steps in the planting of the seed.
24. How much seed will plant an acre?
25. How should the plants be thinned?
26. What cultivation should be given the plants?
27. What legumes are planted in a watermelon field? When are they planted? Why?
28. In thinning the fruit how many are left to the vine?

SUGGESTED EXERCISES

1. Melon growers should be visited often enough for the student to observe each important step in growing the crop. Soil selection, methods of fertilizing, methods of soil preparation, and the implements used are important points. The cost of each operation, so far as can be gotten, should be recorded in the student's notebook.
2. Make a collection of seed from several varieties of watermelons properly labelled. Study these seed and learn to identify the variety.
3. Bring watermelon seed for planting to the classroom and make a germination test. Watch them and in ten days estimate the percentage that are viable.

CHAPTER XXXVII

MELONS—INSECTS, DISEASES, AND MARKETING

Job 5—The Control of Insects and Diseases

The habits and life histories of both insects and diseases should be studied carefully in order to know the most effective measures for controlling them. Spraying is largely a preventive rather than a curative measure. The grower should equip himself, therefore, with a spray outfit and materials in advance of the time that they are to be used.

High Pressure Spray Outfits Necessary.—It is a frequent occurrence that insects and diseases attack the watermelon leaves from the under side. Consequently, the sprays should be so applied that the under as well as the upper surface of the leaves will be coated with the solution.

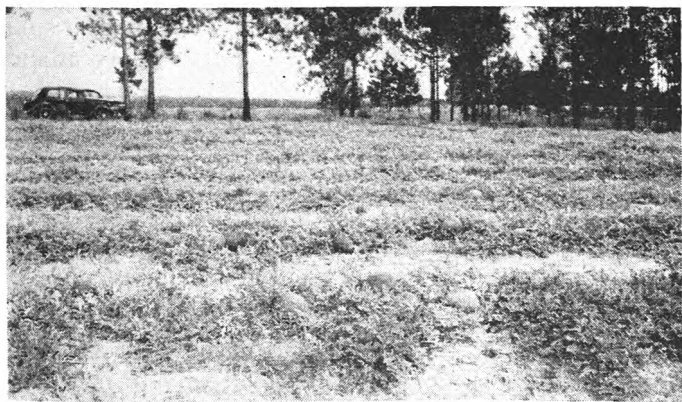
A gasoline power sprayer, mounted on wheels, that will maintain 150 pounds of pressure should be used. Such an outfit will break up the droplets of spray into a perfect mist and set up sufficient air currents to carry the mist to the under as well as to the upper surfaces of the leaves. Hand outfits will not generally do this and are therefore not recommended for spraying watermelons on a commercial scale.

A Spray Schedule for Watermelons.—The watermelon is attacked by a number of insects and diseases that can be more or less controlled by spraying. Therefore, the grower will usually find it beneficial to spray

his plants at intervals of about two weeks from the time they are a few inches high until near the close of the harvest season.

The First Spraying.—Soon after the young watermelon plants come up they are likely to be attacked by both plant lice and the small striped cucumber beetle.

A combination spray can be made for combating both of these insects. It will also largely prevent the attacks



GEORGIA WILT-RESISTANT WATERMELON ON LAND HEAVILY INFESTED WITH WILT

A mixed variety planting on this land the year before was a complete failure, only two stunted vines surviving.

of any diseases on the surface of the leaves. This spray is composed of 3 pounds of copper sulphate, 4 pounds of ordinary hydrated or builders' lime, 1 pound of powdered arsenate of lead, $\frac{3}{8}$ of a pint of 40 percent nicotine sulphate, 3 pounds of soap, and 50 gallons of water. The copper sulphate and lime in this mixture are made into a weak bordeaux mixture according to directions given in the chapter of this text on spraying grapes. The soap—fish oil soap is preferable but laun-

dry soap will do—should be dissolved in a small amount of hot water, the arsenate of lead worked into a thin paste and both added to the bordeaux mixture along with the nicotine sulphate. This makes the combination spray mixture. It may take two or three applications of this spray to get the plant lice and striped cucumber beetles well under control. Treatments for these two insects are given singly under the headings of Plant Lice and Striped Beetle which follow.

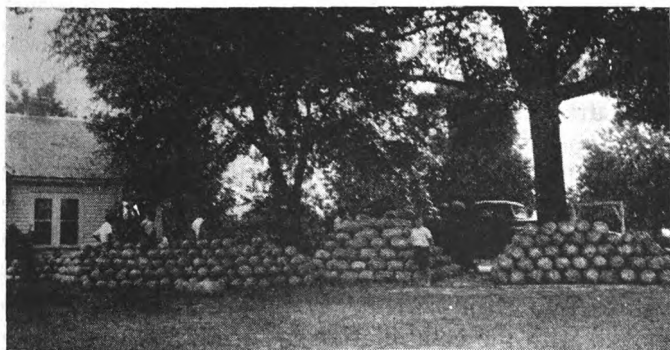
Later Spraying.—Following the combination spray the spraying may be continued with bordeaux mixture made with 4 pounds of copper sulphate, 6 pounds of hydrated lime, and 50 gallons of water. This is to prevent diseases attacking the plants.

The spray applications should be made often enough to keep the surfaces of the leaves and young melons coated with the spray to give them protection against disease. Where the sprays are washed off by frequent rains, it is necessary to spray more often. Anthracnose and downy mildew are two troublesome and common diseases of the watermelon most effectively controlled by spraying the plants with bordeaux mixture.

Plant Lice.—Plant lice, called aphids, live over the winter on weeds which remain green during the cold weather. When the young watermelon vines begin growth in the spring the lice begin to breed and spread from the weeds in or near the field to the melon plants. These lice are very small and attack the leaves on the under side, causing them to curl downward.

A very close watch should be kept for outbreaks of plant lice when the watermelon plants are small. Often only a dozen or so plants will be infested near one side or near some terrace of the field. If prompt measures are taken to check the outbreak serious damage can

often be averted. All the infested plants and those for several yards beyond should be dusted or sprayed as soon as they are found. Where only a few plants are to be treated a hand sprayer or duster may be used. For this work, 40 percent nicotine sulphate may be used as a dust or a nicotine spray may be used. The dust



WATERMELONS AT THE POINT OF PRODUCTION

They are graded according to size and quality, each grade being placed in a different pile affording buyers an opportunity to select watermelons according to grade.

recommended for this purpose is made by adding 1 pound of 40 percent nicotine sulphate to 20 pounds of hydrated lime.

The spray which is recommended for the same purpose is made of the following mixture:

Nicotine sulphate	3/8 pt.
Soap (fish oil soap preferred)	3 lbs.
Water	50 gals.

In treating small numbers of plants the dust and the spray can be made more effective against plant lice if they are applied when the temperature ranges from 65° to 70° F., and the plants are dry. A further measure

which can be practiced on small areas is to construct a funnel of sheet metal or cloth stretched over a wire frame, and set this funnel over each plant for a few minutes after it is sprayed or dusted. This confines the nicotine fumes and kills practically all the plant lice on the plant. However, where large areas are to be treated a high pressure spray outfit becomes necessary.

Striped Cucumber Beetle.—This is a small, black-striped beetle with a black head and yellow thorax. They are very active and attack the plants soon after they appear above the soil. When the plants are disturbed the little beetles drop to the ground and hide themselves in the crevices of the soil. When these beetles become numerous they eat the stems and leaves of the young melon plants so severely that they never mature into strong plants. These beetles may be destroyed with the combination bordeaux mixture and arsenate of lead spray already mentioned, or the plants may be dusted very lightly with calcium arsenate.

Some Diseases Controlled by Spraying.—Anthracnose and downy mildew are possibly the two most serious diseases of watermelons in the South which can be controlled by spraying.

Anthracnose.—This disease is caused by a fungus which attacks all parts of the plants above the ground. It is first noticeable as irregular black spots on the older leaves near the base of the plant. When these spots become numerous the leaves die. The fruit is not attacked severely during dry weather but may be attacked very severely during rainy spells. The spots on the melons caused by this disease are of a dark rusty color, becoming pink in the center when the spores or fruiting bodies of the disease mature. A car loaded with watermelons

containing spots of anthracnose during wet weather may decay and become a total loss before reaching the consumer. Bordeaux mixture, as already mentioned, will control anthracnose if properly applied.

Downy Mildew.—This disease is more severe on cantaloupes and cucumbers than on watermelons. However, it often causes serious damage to watermelons during rainy seasons. Downy mildew appears on the melon leaves first as spots very similar to those caused by anthracnose. If the weather is dry, downy mildew spreads very slowly; but after a few days of damp, cloudy weather the disease may become so severe that practically all the leaves are dried up, leaving the melons exposed to the sun. Melons thus exposed fail to mature and ripen normally and are consequently of very poor quality. Seed treatment and spraying as already discussed should control this disease.

Diseases Which Spraying Does Not Control.—It is frequent that a disease lives in the soil or attacks the plant in such a way that it cannot be reached with sprays.

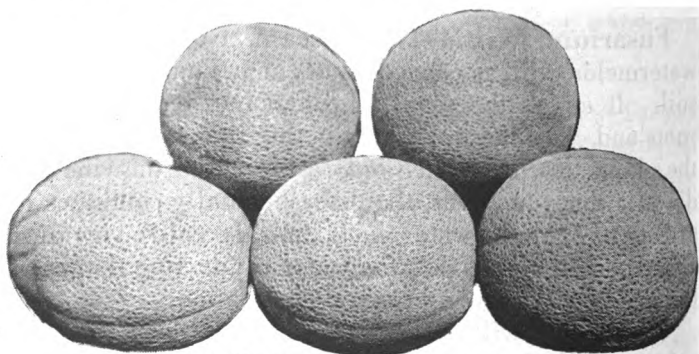
Fusarium Wilt.—This disease, commonly called watermelon wilt, is caused by a fungus and lives in the soil. It enters the plants through the tender growing roots and clogs the water conducting tissue which causes the plants to wilt. Often only a branch of the vine will die at a time; however, the disease usually continues its growth through the water ducts until the entire vine dies. If a diseased vine is cut, the water conducting tissues of the inside will show a brown discoloration.

Watermelon wilt spreads rapidly. If there are only a few wilted plants in a field the first year it is planted to watermelons the disease will very likely spread to

the entire crop if the same field is planted to watermelons the following year. For this reason it is not advisable to follow watermelons with watermelons on the same land for two successive years. Other crops may follow watermelons with little fear of loss, for the fungus causing this disease does not attack any other plant thus far tested.

Stem-End Rot.—This disease is caused by a fungus which enters the melons through the cut ends of the stems and quickly spoils the entire melon. Watermelon shippers often suffer heavy losses from stem-end rot. Cut ends of the stems infected at the time of harvest may cause the melons to decay after they are placed in the car and before they reach their destination.

How Stem-End Rot is Prevented.—The fungus is prevented from entering the melons by applying a disinfectant paste to the freshly cut ends of the stems as the melons are placed into the car for shipment. The paste is made as follows: place three and one-half quarts of water and eight ounces of bluestone (copper sulphate) in an enamel kettle and heat to boiling. Next take eight



Courtesy of The Rocky Ford Cantaloupe Seed Breeders Association

A GOOD COMMERCIAL TYPE OF CANTALOUPE

ounces of laundry starch and work it into a thin paste with one pint of water. Add this starch paste to the blue-stone solution and continue to boil and stir the mixture until a smooth paste is formed. As the melons are loaded into the car, recut the stems and apply this paste to the freshly cut surface with a brush. Where stem-end rot gives trouble, only melons with long green stems should be accepted for shipment.

Root-Knot Nematode.—The watermelon is very susceptible to the root-knot nematode. The same methods used to control this parasite on other crops will prove applicable for watermelons.

Saving Watermelon Seed.—The watermelon grower who has a uniform type of a good variety should save seed from his own crop. In this way he can avoid the possibility of getting a poor grade of seed from someone who has used very little care in selecting them.

Seed should be saved only from well developed, disease-free melons, grown on vigorous, healthy vines. Where the grower does not plant a seed patch expressly for seed production he can go through the field at harvest time and select his seed melons.

When these seed melons are thoroughly ripe they are cut and the pulp containing the seed raked into a barrel. This pulp and seed mixture is allowed to ferment from 24 to 36 hours. Then the barrel is partially filled with water. The seed will sink to the bottom while the fermenting pulp will rise to the top and may be poured off with the water. The seed are then washed through several changes of clean water and spread on cloth sheets in the shade to dry. The seed should be stirred once or twice daily until they are dry. They are then put into thin cloth bags and stored in a cool, dry place where they can be protected against rats and mice.

Job 6—Harvesting and Marketing Watermelons

The grower should make some arrangement for disposing of his watermelons before he begins the job of harvesting the crop. If they are grown for home use or for the local market this task is comparatively simple. But if he is a commercial grower the sale of carload shipments presents a more important problem. The grower can follow the same methods of selling carlots of watermelons as are practiced in marketing carlots of peaches and other perishable commodities. To succeed in this he should use every reasonable precaution to grow and harvest the high class melons which are desired by consumers.

The first step in harvesting watermelons is to know how to tell when they are ripe. There is no definite set of rules for telling a ripe watermelon. This knack comes with experience. Even the crudest laborer has little difficulty in picking out the ripe melons for harvesting after he has worked in the melon fields a few seasons.

Some of the signs followed by the beginner for telling a ripe watermelon are: (1) when the side of the melon which is in contact with the soil changes from a dull white to a white tinged with yellow it is usually ripe; (2) if the melon is thumped with the finger and has a very solid "plank, plank" sound it is likely to be green; but if it has a dull "plunk, plunk" sound, it is probably ripe. This test is best applied when the melons are reasonably cool, for melons not fully ripe may give the "plunk, plunk" sound if thumped during the heat of the day; and (3) when the vine is kept in a healthy growing condition the curl or tendril at the stem of a melon will die at about the same time the melon ripens; however, if the vitality of the vine has been lowered by

disease, dry weather, poor soil, or some other similar cause, the "curl" will die before the melon becomes ripe.

How the Watermelons Are Gathered.—Watermelons should be harvested when the meat is fully red, but not over ripe. Before beginning the harvest, the field should be divided into sections of eight rows each. The vines are turned or laid away from the space between the eighth and ninth rows in order to provide a driveway for wagons or trucks to haul out the melons.

The most experienced workers go through the field and cut the stems of those melons ready to be harvested. Ordinary pocket knives may be used for this purpose. A long stem, but no part of the vine, is left attached to each melon. As the stem is cut, the melon is turned over so that the white spot which was next to the soil will indicate to the "tote" boys which melons are to be carried over to the driveways. The melons are carefully placed in small piles along the driveways and laid on their sides, rather than on their ends. The greatest care should be taken here, as well as in handling the melons on the wagons or in the cars, not to skin or bruise the melons.

How Watermelons Are Graded.—Watermelons which have been carefully thinned will be rather uniform in size at the time of harvest. In this event the grower harvests only those watermelons which will grade the size which he has the greatest number of and which he desires to ship. For example, if the prevailing size is about 30 pounds, he will have harvested only those which will vary no more than a pound or two from this size. When these are harvested and the car loaded, he may be able to ship another car of melons grading from 24 to 26 pounds or from 34 to 36 pounds. These, of course, are shipped separately.

Some growers follow the practice of harvesting the different grades at the same time and then separate them as they are loaded on the trucks or wagons to be hauled from the field to the cars.

Hauling Watermelons and Loading the Cars.—The watermelons are hauled from the field to the cars in either wagons or trucks. The truck and wagon beds should be smooth and lined with cloth to prevent injury to the melons. Ordinary farm wagons should be equipped with bolster springs so as to prevent jolting. A sufficient number of trucks or wagons should be used to haul so that the car can be loaded with melons on the same day they are harvested. If the job can be done by noon, the car sealed and ready to move in the early afternoon, it is all the better.

Disinfecting and Padding.—Only clean railroad freight cars should be used for shipping watermelons. Cars which have contained watermelons recently should be cleaned and sprayed with a disinfectant. Two pounds of bluestone dissolved in twenty gallons of water will serve for this purpose. The car should be dry before the melons are put in. It should have the floor covered with dry bedding to the depth of three or four inches, and the walls lined with building paper to the height of about three feet to prevent bruising the melons in transit. Care should be taken, however, not to allow the paper to seal up the ventilator openings of the car.

Loading the Cars.—As the truck or wagon comes in from the field loaded it is driven close up to the car door. The driver hands the melons to the packers in the car. The melons are carried to the end of the car and laid on their sides. It takes about 14, placed side by side, for the first row across the car. The number,

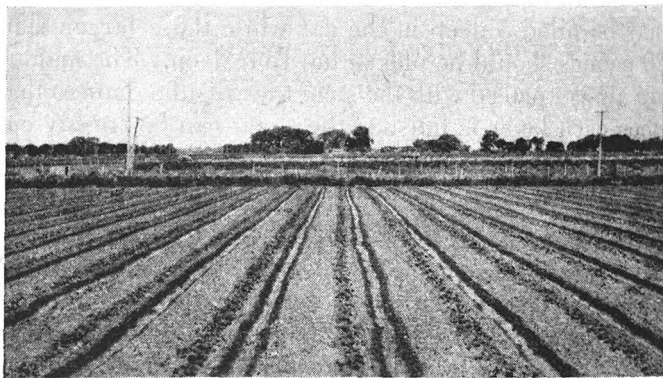
of course, depends upon the size. The next layer on top of this is composed of only 13 melons which fit in on top of these. The third layer is composed of 14 and the fourth of 13, and so on. Melons up to 20 pounds may be piled 5 deep in the car while those larger than 20 pounds should be placed but four deep. The melons are always placed with the stem towards the door so that when each layer is finished the stems can be freshly cut with a sharp knife and the cut surface coated with a disinfectant to prevent stem-end rot in transit.

Number of Melons Required to Fill a Car.—

Cars vary in size, though on the average it takes 821 melons, weighing 28 pounds each, or 767 weighing 30 pounds each, to fill a car. Other sizes may be expected to vary accordingly. It is not considered a good practice to ship two sizes of melons in the same car for the buyer will usually offer the price of the smaller size for the entire lot. However, in a case where it becomes necessary to ship two sizes in the same car, they should be placed in opposite ends.

Precautions to Be Observed in Handling Water-melons.—The grower will profit materially from observing the following precautions in handling water-melons: (1) if it can be avoided, do not harvest melons when the vines are wet; (2) be careful not to allow the knife to slip and cut into the rind of the melon when the stems are cut; (3) insist on careful handling at every stage in the process of harvesting; (4) pad or line the wagons or trucks as well as the railroad cars to prevent cuts or bruises; (5) load the melons on the same day they are harvested and use a clean, dry, railroad car for this purpose; (6) use clean excelsior rather than pine straw for bedding in cars; (7) do not stand or sit on melons while they are being hauled or loaded; (8)

reject melons that do not have a firm, green stem, or that show sun scald or anthracnose spots; and (9) disinfect freshly cut ends of stems as the car is loaded.



Courtesy of The Rocky Ford Cantaloupe Seed Breeders Association

THE IRRIGATION OF CANTALOUPE

The water should seep out to the roots of the plants and the field should never be flooded.

CANTALOUPE OR MUSKMELONS

Cantaloupes require essentially the same kind of location, soil type, soil preparation, fertilizer, time of planting, cultivation, and spraying as given for watermelons. Those points differing from watermelons are *varieties*, *spacing of the plants*, and *methods of harvesting and shipping*. There are also a few *insects and diseases* which attack cantaloupes more severely than watermelons.

Selecting the Varieties of Cantaloupes.—In selecting varieties of cantaloupes for home use, quality and production are two factors to consider. Often a variety may be large, long, and soft and entirely unfitted for shipping, but of good quality and well suited for

home consumption. For shipping long distances, a small cantaloupe of good quality and with a closely netted, firm rind is desired.

Some of the varieties well suited for home use are the Nixon, Osage, Banana, Cannon Ball, and Hackensack.

Most commercial varieties of cantaloupes grown in



CANTALOUPE PRODUCTION IN THE UNITED STATES

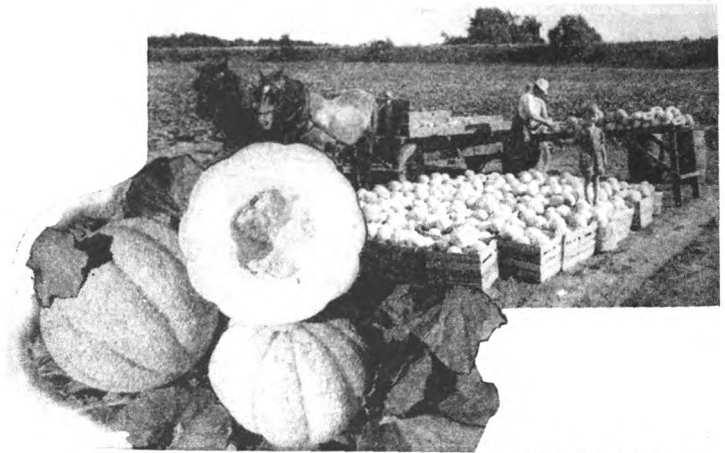
Each dot represents 1,000 acres.

the southeastern part of the United States belong to the "Netted Gem" or "Rocky Ford" type. Several strains or types of these have been developed by the different breeders and seed growers. They are all striving to produce good shipping qualities combined with good eating qualities and resistance to insects and diseases. Some of the popular commercial varieties are Pink Meat, Pollock, Rocky Ford, and Eden Gem.

Distance to Plant Cantaloupes.—Cantaloupes may be planted by the hill or by the drill method. In planting by the hill method the land is checked from four to five feet apart each way to permit cultivation in

both directions. From six to eight seed are planted in each hill and the plants thinned to two plants to the hill when the second pair of leaves appears.

In planting by the drill method the rows are laid off five feet apart and the seed put in with a seeder which drops them only a few inches apart. The plants are



Courtesy of Joseph Harris Company, Inc.

HARVESTING CANTALOUPE. INSERT, A POPULAR TYPE OF CANTALOUPE

thinned to a distance of about 20 inches apart in the drill and only one plant left at a place.

Spraying Cantaloupes.—The same spray schedule given for watermelons will apply to cantaloupes except that it may be necessary to give one or two extra dustings with calcium arsenate about the time the vines begin to blossom to assist in controlling the pickle worm which bores into the vines and the melons.

Harvesting and Shipping Cantaloupes.—The cantaloupe is a quickly perishable product and must be shipped in refrigerator cars if it is to be sent to distant markets. It must also be harvested before it becomes fully ripe if it is to be shipped long distances.

The cantaloupes for home use and for the local market should be allowed to ripen on the vines. It requires some skill and experience to know the proper stage to pick them for shipping. The flesh of the cantaloupe first becomes sweet, and then soft at the stem end. The proper time to pick for shipping is after the flesh becomes sweet and before it begins to soften at the stem end. This period is longer when the cantaloupes first begin to ripen while the vines are vigorous and green, than towards the close of the harvest season or when the leaves have been badly damaged by disease. From one to two days is as long as this period may be expected to last. If the cantaloupes are picked before the flesh becomes sweet, they are practically worthless, for a cantaloupe does not gain in sugar content after it is picked, even though it does improve in flavor. If harvested after the stem end begins to soften it is likely to become over ripe and spoil in transit. The netting on most varieties of cantaloupes begins to take on a slight ashy grey color when they are ready to be picked for shipping. It may be necessary for the beginners to cut a few to determine the relation between the color on the outside and the sweetness of the flesh to determine the proper stage at which to harvest.

Picking Cantaloupes.—When the harvest season begins, the fields should be picked over every day to prevent some of the cantaloupes becoming too ripe for shipping. Such frequent pickings necessitate about 100 acres planted to a single variety to have a sufficient quantity to ship a carload each day.

Half bushel baskets used for harvesting peaches are very satisfactory for harvesting cantaloupes. As the cantaloupes are picked they are hauled to the packing shed where they are graded and packed into crates for shipment.

Grading and Packing Cantaloupes.—Some of the large growers have mechanical graders for grading cantaloupes, though this work is more commonly done by hand. Some of the commercial growers grade their cantaloupes into three sizes: four inches, four and a half inches, and those over four and a half inches in diameter. All under four inches are taken out as culls. The four inch and four and a half inch melons are packed in crates with heads 12 by 12 inches and the sides 24 inches long. It takes 45 of the four-inch cantaloupes to make a crate and only 36 of the four and a half-inch melons to fill one. Well developed choice cantaloupes larger than four and a half inches in diameter are frequently packed in flat crates, called "flats." These are usually 5 inches deep, 15 inches wide, and 24 inches long and hold 15 cantaloupes each. It is very important that cantaloupes be graded, packed, and put into refrigerator cars the same day they are harvested.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Why do we spray?
2. Why are high pressure spray outfits necessary?
3. How often should watermelons be sprayed?
4. When should the spray schedule begin?
5. For what is the combination spray used?
6. What later spray is used? For what purpose?
7. What two diseases are controlled by proper spraying?

8. Where do plant lice attack the plants?
9. What remedy is recommended for small infested areas?
10. Describe the striped cucumber beetle. What remedy is recommended for its control?
11. How would you recognize anthracnose? What damage does it do? How can it be prevented?
12. What effect has downy mildew on the plant? How can it be prevented?
13. What are the diseases that spraying cannot control?
14. How can you recognize fusarium wilt?
15. How is stem-end rot prevented?
16. What type of melons should be used as seed melons?
17. How is the pulp separated from the seed? What care should be taken of the seed?
18. How can you tell when a melon is ripe?
19. Give the steps in gathering watermelons?
20. How are melons graded?
21. What precautions should be taken in hauling the melons and disinfecting the cars?
22. How are the cars loaded?
23. How many melons are required to fill one car?
24. Give nine points that should be observed in handling watermelons.
25. In what respect does the culture of cantaloupes differ from watermelons?
26. What type of cantaloupe is adapted for shipping?
27. Name some varieties suitable for home use; for shipping.
28. How are cantaloupes planted by the hill method; by the drill method?
29. What additional dustings should be given to cantaloupes that are not given to watermelons?
30. How should cantaloupes be shipped if sent to distant markets?
31. When should a cantaloupe be harvested for home use or the local market?
32. When should a cantaloupe be harvested for shipping?
33. How are cantaloupes graded?
34. How are they packed?

SUGGESTED EXERCISES

1. Visit nearby farms and study the type of spray machinery used and the kind of sprays employed in the control of insects and diseases of melons.
2. Make a collection of specimens of both insects and diseases attacking melons in your community and identify each. Send specimens to your state experiment station or agricultural college for identification in case no member of the class can name them.
3. Study methods of harvesting, loading, and shipping melons in your community. If several varieties are grown, have a melon cutting with several important varieties represented, and make careful notes of the qualities and a description of each in your notebook. Make some decision as to which are best for the locality in which they are grown.

SEASONAL WORK WITH MELONS

There is not a great deal to be done in the melon fields from the time the crop is harvested in late summer until late winter or early the following spring when plowing begins for the next crop. Consequently, the melon grower has considerable time to devote to other crops during his off-season.

September, October, and November

1. Harvest hay from summer cover crop grown in the melon fields.
2. Sow winter cover crop for improving the soil.

December, January, and February

1. Procure seed and fertilizers, as well as make plans for growing and marketing the crop.
2. Remove stumps and tree roots from newly cleared land and begin breaking the soil for melons.

March, April, and May

1. Prepare and fertilize the soil for planting.
2. Disinfect and plant the seed.

3. Begin cultivation soon after the plants come up and protect them against insects and diseases.
4. Provide picking baskets and shipping crates if any cantaloupes are to be shipped.
5. Locate an extra supply of labor for harvesting the crop.

June, July, and August

1. Continue to cultivate and spray the vines to keep them in a vigorous healthy condition.
2. Harvest and market the melons as they ripen.
3. Plant a summer cover crop in the melon fields to produce hay or to improve the soil.

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CHAPTER XXXVIII

TOMATOES—SELECTING LAND AND PROCURING PLANTS

Job 1—Selecting the Land for Tomatoes

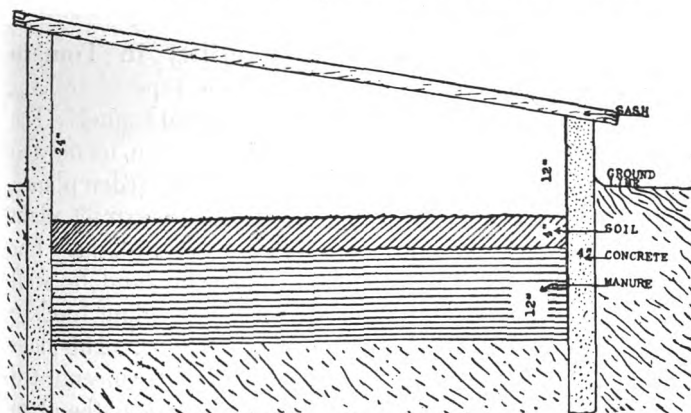
The tomato is one of the most widely grown of all our truck and garden crops. It is adapted to practically all the soil types ranging from the heavy clays to the mucks and light drifting sandy soils. However, tomato growing is not profitable on some of the poorer soils unless their fertility can be increased with little expense or the fruit sold at high prices.

The tomato has a place in every home vegetable garden of the South, but it should be grown on a commercial scale only where there are favorable conditions for growing and selling the crop at a profit.

Selecting the Land for Growing Tomatoes for Distant Markets.—In selecting a location for growing tomatoes to ship to distant markets, the following factors should be considered: (1) the time of year the fruit ripens, which largely determines the competition the fruit must meet on the markets; (2) the nearness to the railroad station or point of delivery; and (3) the productivity of the soil.

Where the location is far enough south for the tomatoes to ripen during the winter and thus have little competition on the markets, the product will usually command a price sufficient to justify long freight hauls and relatively low yields which frequently occur on thin sandy soils especially adapted to early maturity of the crop.

Influence of Exposure or Slope on Earliness of Tomatoes.—Land sloping to the southeast with good air drainage and protected on the north and west by a body of timber or some other natural barrier may be set to tomato plants much earlier in the spring than areas not thus protected. Cases are on record of plants on such protected fields escaping injury by frost, while those in nearby unprotected fields have been killed.



CROSS SECTION OF HOTBED

Dig the pit, frame it, fill with manure, top with soil, and cover with sash.

In some sections exposure is an important matter, for any factor which will enable the grower to get his tomatoes on the market early will greatly increase his profits. A small crop that reaches the market early is often more profitable than a much larger crop that reaches the market only a few days later.

Importance of Selecting Land Near Shipping Station.—Land for growing any crop producing a large tonnage should be located as near the shipping station as

possible. An acre of fertile land will produce five or more tons of tomatoes. Every additional mile this tonnage must be moved during the process of harvesting and shipping means additional labor and expense to the grower. Moreover, the tomato is a perishable fruit easily injured by rough handling. It is therefore highly important that the crop be handled carefully and quickly. This can be done more conveniently if the crop is grown near the shipping station.

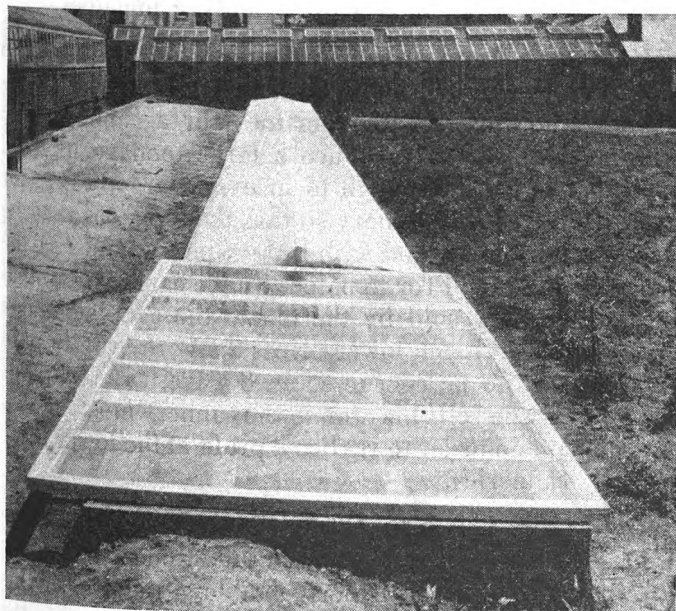
The Importance of Soil Fertility in Tomato Growing.—As already mentioned, the type of soil for growing tomatoes is not such an important matter. The roots of a tomato are shorter in proportion to the top growth than those of most other truck and garden plants. The feeding roots also seem less able to extract plant food from the soil than a number of other plants. For this reason it is very important that the land be well prepared and that an abundant supply of plant food be placed within easy reach of the root systems. This does not mean, however, that large quantities of concentrated fertilizers should be placed in the furrow near the plant without being thoroughly mixed with the soil; for such a practice would injure rather than stimulate root growth of the tomato plant.

Land which is not already fertile should be improved by growing and turning under cover crops or by liberal applications of stable manure for a year or two before being planted to tomatoes.

Importance of Soil Drainage and Disease-Free Soils.—The tomato plant thrives with a liberal supply of moisture, but does not grow well on wet, poorly drained soils. It is especially important that land selected for growing tomatoes be free of the root-knot nematode and the fusarium wilt of tomatoes. This can

usually be determined by an examination of nematode susceptible plant roots from several sections of the farm during the growing season; and by inquiry of reliable parties familiar with local conditions relative to tomato wilt, as well as by examinations of any tomato plants found growing on the place.

Selecting the Land for Growing Tomatoes for the Local Market.—Tomatoes are in demand on the



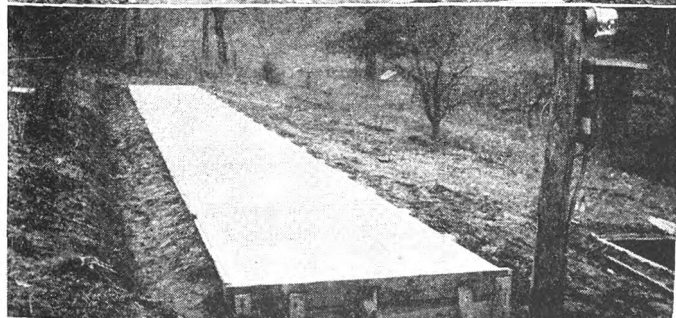
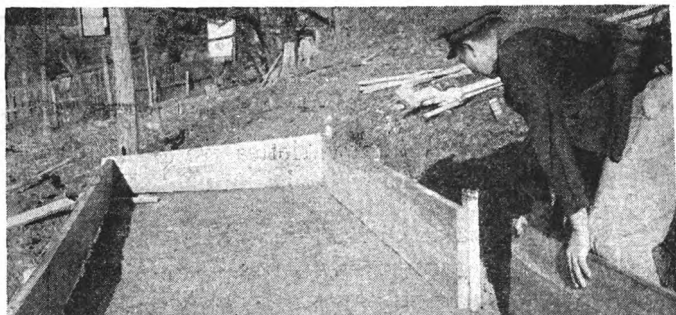
HOTBED FOR GROWING EARLY TOMATO PLANTS SHOWING TWO TYPES OF COVERS TO HOLD THE HEAT AND KEEP OUT RAIN

markets of practically all cities and to a limited extent even in the smaller towns. Consequently, truck farms for growing tomatoes, along with other truck crops, are found located on the outskirts of every town and city of

any size. With the improvements of the roads and methods of rapid transportation by trucks and automobiles, these truck farms can be located at much greater distances and still have the produce delivered promptly to the customers each morning if necessary. Therefore, for supplying tomatoes to the local market the land should be selected with reference to (1) accessibility to the market, (2) proper slope and soil type for the production of early tomatoes, and (3) soil with sufficient fertility to produce satisfactory yields of tomatoes.

Selecting Land for Supplying Tomatoes to the Cannery.—Three important factors to consider in selecting land for growing tomatoes for a cannery are: (1) land which will produce a large tonnage, that is, land that is fertile enough to insure a large crop; (2) accessibility to the cannery so that the tomatoes may be delivered promptly and with little expense; and (3) the contract price paid for tomatoes by the cannery. Tomatoes are usually sold by the ton to the canning plants and are sold at much lower prices than are usually paid for tomatoes to be consumed in the fresh state. Thus the grower who sells his crop to the cannery must emphasize tonnage in order to realize a profit at the lower price paid by canneries.

Selecting Land to Grow Tomatoes for Home Use.—Tomatoes for home consumption are usually grown in one section of the vegetable garden. For this reason there is no very wide range of soil selection for this purpose, unless the crop is grown outside the home vegetable garden. Crop rotation within the vegetable garden should be practiced, for often the attacks of both the nematode and tomato wilt can be greatly reduced by changing the place of planting tomatoes in the garden every year.



Courtesy of Tennessee Valley Authority

ELECTRIC HOTBEDS

(a) Showing method of constructing hotbed frame. The bottom of the hotbed frame should be level. The back wall of the hotbed frame should be six inches higher than the front wall. (b) Method of spacing lead-covered, soil heating, cable in electric hotbed. (c) Electric hotbed complete with sash. Note that the hotbed is located so that it is not shaded by any buildings or trees.

Job 2—Procuring the Plants

Before providing a supply of tomato plants it is necessary to decide (1) what varieties are to be used, and (2) whether the plants are to be purchased or whether they are to be grown at home.

Varieties of Tomatoes to Use.—Several hundred varieties of tomatoes are known. The varieties to select should depend upon the purposes they are to serve. They should be selected for quality, yield, color, size, shape, succession in time of ripening, and disease resistance. The following are some from which selections may be made:

VARIETIES FOR SHIPPING

Early Varieties

Penn State Earliana
Sunnybrook Earliana
Bonny Best
Earliana
June Pink

Second Early and Midseason Varieties

Louisiana Gulf State
Globe
Everbearing Scarlet Globe
Prichard
Dixie

Varieties Resistant to Tomato Wilt

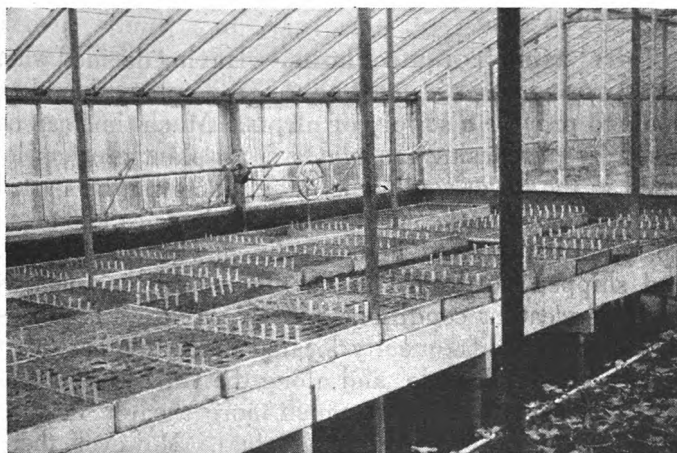
Marglobe
Improved Marvel
Norton
Louisiana Pink
Prichard

Varieties for Canning

Marglobe
Prichard
Everbearing Scarlet Globe
Stone

For the home vegetable garden and the local market, Penn State Earliana is one of the best for the early crop. The vines are rather small and the fruit is dark red, fairly smooth, and about the first to ripen.

The Globe is a good second early variety to plant along with the Earliana. The Globe is a stronger grower than the Earliana, ripens a little later, and is very good for home use as well as for shipping. The fruit is almost round, reddish-pink in color, from medium to large in size, and has a very mild flavor. There are several midseason varieties which follow the Globe that are desirable. If the grower desires to can the surplus, a rich, red-fleshed, large, smooth variety should be planted. The Stone and Greater Baltimore are desir-



*Courtesy of Bureau of Plant Industry, Soils, and Agricultural Engineering,
United States Department of Agriculture*

SEED FLATS IN GREENHOUSE WITH GERMINATING TOMATO SEEDLINGS

able for this purpose. Where the grower gives his tomatoes the best of culture and desires extra large tomatoes that produce large slices for table use, the Ponderosa and Brimmer are good selections.

Those desiring yellow varieties will find Henderson's Yellow Ponderosa good for home use. The Golden

Queen, which is somewhat smaller, is also a good yellow variety.

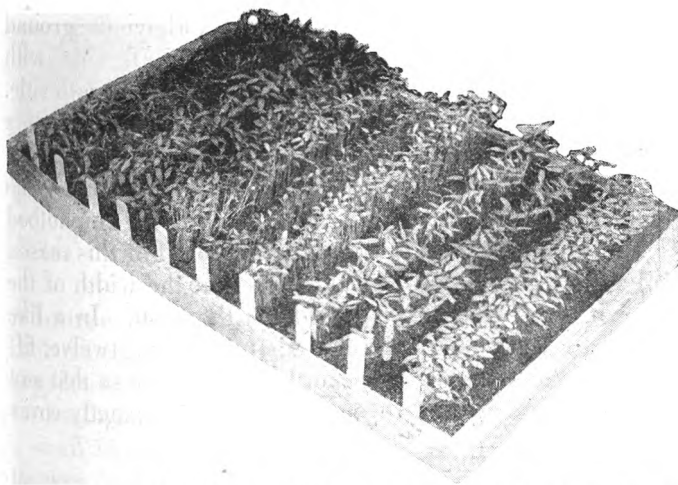
The same varieties recommended for home use and the local markets may be used for producing a crop of fall tomatoes. The seed are planted the latter part of May in time to mature the crop before the vines are killed by frost in the fall. It is better to use the early maturing varieties, such as Earliana and Globe, for the fall crop in the upper South. Such varieties serve well also in other sections of the South where the grower does not set his plants in the field until late in the summer.

Purchasing Tomato Plants.—Having decided what variety or varieties of tomatoes to grow, plans should be made to provide a supply of plants. Much time can be saved by purchasing the plants from plant growers located in the lower south where the plants can be started outdoors early in the spring. These plants can be taken up, carefully packed in boxes lined with damp moss, and shipped northward to be planted in the open as early as weather conditions are favorable. Plant beds of this kind are frequently located in the southern part of Georgia, in Florida, and along the Gulf Coast. Tomato plants can be grown much more cheaply in open beds than in heated beds under glass. However, there is always some inconvenience in having to ship plants a considerable distance for planting, as they are likely to arrive when soil or weather conditions are not favorable for transplanting. There is also some danger of tomato diseases, especially tomato wilt, being scattered in this way.

Growing Tomato Plants at Home.—In order to have early tomatoes it is important to start the plants in beds protected against frost some seven or eight weeks

before the weather becomes warm enough to risk setting plants in the open field, for it requires from 85 to 110 days after the seed are sown to produce ripe fruit. It requires six weeks, and eight weeks is none too long, to produce good stocky tomato plants desirable for planting in the early spring.

The method used for starting tomato plants before the weather becomes warm depends very largely upon the number to be grown. A few plants for the home garden may be started in shallow wooden boxes filled with soil and kept in the home. These boxes of plants may be kept in sunny windows during the day and protected against cold at night. Large numbers of plants, however, can be handled better in greenhouses or hotbeds. Greenhouses are generally too expensive for this purpose but hotbeds are usually satisfactory.



*Courtesy of Bureau of Plant Industry, Soils, and Agricultural Engineering,
United States Department of Agriculture*

TOMATO SEEDLINGS READY FOR POTTING-OFF

Hotbeds.—A hotbed properly constructed provides for some form of heat from beneath and is covered with some material, as glass or white cloth, which admits light and keeps out cold. Hotbeds should be located on the south side of a building, a board fence, or on the southern slope of a hill where the soil is well drained and where the beds will be protected from the north and northwest winds. The covering of the hotbeds should slope to the south which will enable the plants to receive more warmth and light.

The first step in the construction of a hotbed is measuring out the area six feet wide and as long as may be desired. Dig out this area to the depth of from 12 to 14 inches. Hotbed frames may be constructed of wood, brick, or concrete.

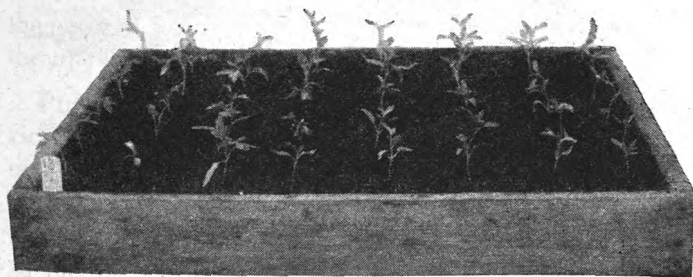
Wooden Frames.—Construct a frame of good lumber one and one-half inches thick to fit into this excavation. The frame should extend two feet above the ground on the north side and one foot on the south side, with ends uniformly sloping from the north to the south side. The top of the frame should be faced all around with a two and one-half inch strip of dressed lumber so that the sash or covering of the bed will fit close and exclude the air during cold weather. The standard size for hotbed sash is six feet long and three feet wide. For this reason hotbeds are made six feet wide so that the width of the bed will conform to the length of the sash. In a like manner, the length of the bed should be six, twelve, fifteen, eighteen feet, or some multiple of three so that any given number of sash three feet wide will exactly cover the bed.

Brick or Concrete Frames.—Brick or concrete may be used instead of lumber where permanent hotbeds are desired. The walls made of these materials need

be only four inches thick. The side walls are given the same height and the end walls the same slope as indicated for the wooden frame. The top of the walls are faced with a two by four inches dressed scantling, imbedded in mortar, for the sash to rest on.

About 625 brick and a bag of cement with some sand for mortar will be sufficient to construct the brick walls for a hotbed six feet wide and fifteen feet long. Three parts of sand to one part of cement should be used for the mortar in putting up the brick walls. Two pieces of scantling fifteen feet long and one piece twelve feet long will be enough scantling to face the walls.

The amount and cost of materials for putting up concrete walls for a hotbed can be supplied by almost any one engaged in concrete construction work.



FLAT OF YOUNG TRANSPLANTS PROPERLY SPACED FOR FURTHER GROWTH AND HARDENING

Sources of Heat for Hotbeds.—Plant beds of this kind may be heated by steam or hotwater pipes connected with a boiler installed for the purpose or used for heating a building. Another method is to construct a small furnace at one end of the bed, pass the smoke through a large passageway under the bed and up through a smoke stack at the opposite end. Wood or coal may be burned for keeping up the heat by this

method. There are two serious objections to this method of heating beds; namely, one end is likely to be too hot while the other is too cold, and it requires a considerable part of an attendant's time to keep up the fires.

Fermenting cotton seed produces sufficient heat for hotbed purposes; though the heat is less uniform than that produced from stable manure, and the commercial value of cotton seed makes them very expensive for this purpose.

Fermenting horse or mule manure produces a very even degree of heat and is a satisfactory material for hotbeds. Cow manure produces very little heat and is not satisfactory for this purpose.

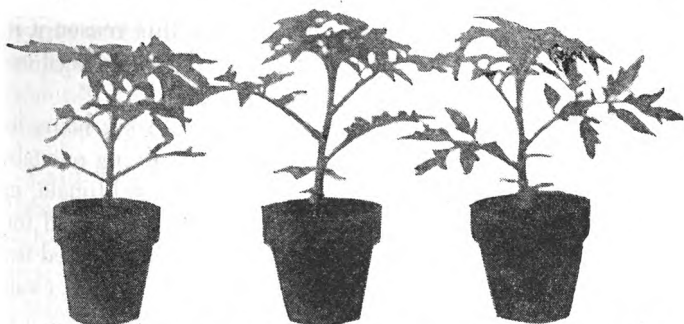


FLAT OF STOCKY AND HARDENED PLANTS READY TO BE SET OUT IN THE FIELD

The hotbed should be prepared and the tomato seed sown from six to eight weeks before it is time to set the plants in the open.

After the new hotbed frame has been constructed and the sash with which to cover it on hand or the old hotbed has been cleaned out, fresh stable manure, including such bedding and material commonly mixed with the manure, should be hauled and packed into the hotbed excavation to the depth of ten or twelve inches after it

is well packed. The manure should be sprinkled with water as it is put in and sprinkled on top after it is well trampled down. Only enough water is used to moisten



POTTED TOMATO PLANTS READY FOR TRANSPLANTING TO THE FIELD

the manure well. If water can be squeezed out by hand the manure is too wet.

Putting the Soil into the Hotbed.—A layer of rich sandy loam soil is put on top of the manure to the depth of four inches. Loamy soil containing a large percentage of leaf mould called “woods earth” is very satisfactory for this purpose. If considerable quantities of hotbed soil are needed it is well to compost cow manure, forest tree leaves, and soil in equal parts about six months before it is to be used. Another good soil for this purpose is made by composting cow manure and grass sod in equal parts from six to twelve months before it is to be used.

The first two inches of soil put on the manure may be somewhat coarse and contain small lumps, but the upper two inches should be run through a coarse sand screen to remove the lumps and trash. This leaves the surface in excellent condition for sowing the tomato seed.

Disinfecting Tomato Seed to Kill Disease Spores.—It sometimes happens that tomato seed harvested from diseased plants will contain spores on the surface which develop and infect the young plants as the seed sprout in the plant beds. For this reason it is best to be on the safe side and treat all tomato seed before planting them.

First soak the tomato seed from five to six hours in water. Then make up a solution by dissolving one tablet of mercuric chloride, called corrosive sublimate, in one pint of water (1 to 1,000) and soak the seed for three minutes in this solution. Next, wash the seed ten minutes in running water or in several changes of clean water, and then plant them in the usual way.

Temperature of Hotbed for Sowing Tomato Seed.—Frequently, when the hotbed is first made, the fermenting manure will raise the temperature of the bed to over 100° F. It is well to place a thermometer in the soil and not sow the seed in the bed until the temperature falls below 90°, which will usually occur within three or four days after the manure is put in.

Sowing the Seed.—The seed are sown in drills made about one inch deep and six inches apart. Seed may be sown much thicker when the plants are to be potted or transplanted to other beds when small than where they are allowed to stand until ready to be transplanted to the field. One ounce of tomato seed should produce about 2,000 good plants. Four ounces of seed should produce enough plants to set an acre.

Care of the Hotbed.—As soon as the seed are sown and covered the surface of the soil is watered. A sprinkler or watering pot which makes possible the application of a finely divided spray should be used to prevent

the water compacting the soil over the seed. The sash or covering material is then put on. It is necessary to watch the bed carefully after the seed are sown. Water is applied as the soil becomes dry, and the sash raised to give fresh air when the bed becomes too warm. A temperature of from 70° to 85° during the day, and from 60° to 65° at night affords good growing conditions for tomato plants.

Cold Frames for Hardening of Plants.—A cold frame is constructed in practically the same way as the hotbed except that *no manure is used* to keep up the heat; as a matter of fact, a “spent” hotbed makes an ideal cold frame. Often cloth tacked to a frame is used instead of glass as a cover for the cold frame.

Cold frames are used for transplanting the young tomato plants from the hotbed to harden them off and cause them to become well rooted and stocky. The transplanting is done when the plants are from two to three inches high. They are spaced about two inches apart each way and allowed to remain in the cold frame until they are eight or ten inches high or until time to set them to the field. Tomato plants handled in this way live better and withstand the shock of being set to the field much better than when transplanted in a tender condition directly from the hotbed to the field.

Use of Pots and Flats for Transplanting Tomato Plants.—Growers having only limited numbers of tomato plants to handle often transplant them to small clay or paper pots. They are grown in these pots until the roots thoroughly mat the soil, at which time they can be removed and set to the field with very little disturbance to the root system.

Some growers follow the practice of transplanting the small tomato plants from the seedbed to shallow wooden

boxes called "flats." These flats are filled with a mixture of fertile soil and finely broken sod or leaf mould. The plants are spaced from two to three inches apart in the flats and allowed to grow undisturbed until about a week or ten days before they are to be set to the field. At this time the soil of the flat is cut into checks with a long bladed knife, leaving each plant growing in a small block of soil. The cutting of the roots will cause them to branch and each plant will thoroughly mat its block of soil with roots. Handled in this way they are very easily transplanted to the field.

Several other methods in addition to those described may be used for growing tomato plants. Regardless of the method used, however, the aim should be to produce vigorous, stocky, well-hardened, healthy plants sufficiently early in the season that the plants can be placed out of doors as early as the weather and the soil become warm in the spring.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Where are tomatoes grown?
2. To what types of soil are tomatoes adapted?
3. What should determine the selection of suitable land?
4. For what purposes are tomatoes grown?
5. In selecting land for tomatoes that are to be shipped to distant markets, what points must be considered?
6. What advantages has land for tomatoes in south Georgia and Florida and other sections with similar climate?
7. Why must exposure or slope be considered in selecting the land?
8. Why should the land be near a shipping station?
9. Why is fertility of such importance in a tomato field?

10. How can you determine whether or not a field is free of nematodes and tomato wilt?
11. In selecting land for growing tomatoes for the local market, what points should be considered?
12. In selecting land for growing tomatoes for the cannery what points should be considered?
13. Why should crop rotation for tomatoes be practiced in the home garden?
14. What varieties of tomatoes are planted in your neighborhood? Are they early varieties or midseason?
15. Give a selection of varieties that will produce a succession of tomatoes until frost in the upper South.
16. What varieties are planted for a fall crop?
17. What are the two methods of providing early tomato plants?
18. What is the advantage in buying those grown further South?
19. What are the disadvantages?
20. In starting plants at home why is it necessary to grow them in a protected bed?
21. How long should the seed be sown before the plants are ready to be set to the field?
22. How can a few plants be grown early for home use?
23. What is a hotbed?
24. Where should the hotbed be located?
25. Give the steps in the construction of a hotbed.
26. What are the sources of heat for a hotbed?
27. What kind of stable manure is used?
28. Give the steps involved in putting stable manure in the beds.
29. What kind of soil should be put on top of the manure? How thick?
30. Why should tomato seed be treated before planting?
31. Give the method of treatment.
32. What should be the temperature of the bed when the seed are sown? How can this be tested?
33. How are the seed sown? How many ounces of seed are sown in order to produce enough plants for an acre?

34. What temperature affords good growing conditions for the young plants? What care should the hotbed receive?
35. What is a cold frame? For what is it used?
36. When are the young plants transplanted to the cold frame and how long do they remain in the cold frames?
37. Describe other methods of transplanting the young plants.

SUGGESTED EXERCISES

1. Visit nearby tomato growers and study their methods of growing tomatoes. Note the influence of soil type and exposure on earliness of maturity of the crop and the relation of crop rotation to the amount of disease present.
2. Study the influence of the distance the grower has to haul his tomatoes to the market, cannery, or shipping station, on the profits he makes on the crop. Try to determine from these records the maximum distance it is profitable to haul tomatoes in your community.
3. Collect a few samples of tomato seed and make germination tests according to directions given in this text. Design a seed germinator of other materials, keeping in mind the heat and moisture requirements of tomato seed to germinate.
4. Visit nearby truck farms and study methods of constructing, heating, and starting plants in hotbeds.
5. Construct, either as a class project or at the home of one of the members of the class, a hotbed and a cold frame and plant seed and care for tomato plants as indicated in the text.

CHAPTER XXXIX

TOMATOES—PREPARING LAND AND SETTING PLANTS

Having provided a supply of plants to be set in the field as soon as the danger of frost has passed in the spring, the next job is to get the land ready for the plants. Implements generally found on the farm will serve for use in growing a crop of tomatoes. The turn plow and disk harrow are two which are very serviceable in getting the land ready for tomato plants.

Unless a winter cover crop is being grown on the land it should be broken in the late fall and allowed to remain without further attention until three or four weeks before the plants are to be set. The soil should be broken from seven to ten inches deep and care taken not to turn up a large amount of the subsoil. Some growers wait until early spring, however, to break the land for tomatoes. In either case the soil should be thoroughly harrowed once or twice in the spring before setting the plants.

Fertilizers for Tomatoes.—It requires a fertile soil to grow a good crop of tomatoes. It is much more difficult to take a very poor piece of soil and apply enough fertilizers to produce a large crop of tomatoes the first year than on land which has been well fertilized for several years.

Stable Manure for Fertilizing Tomatoes.—Stable manure is a good fertilizer for tomatoes. If a supply is available, from 12 to 15 tons per acre should be applied broadcast over the soil and harrowed in three or

four weeks before the plants are to be set. If only five or six tons to the acre are available, it should be applied in the drill. The stable manure should be supplemented by commercial fertilizers applied at the rate of from 400 to 800 pounds to the acre.



SETTING OUT TOMATO PLANTS WITH A HAND TRANSPLANTER

Commercial Fertilizers.—The scarcity of stable manure in some sections makes it necessary that commercial tomato growers rely almost entirely upon commercial fertilizers for fertilizing their crop. Just what fertilizer mixture the tomato grower should use is a question worthy of serious study. No one mixture will serve best for all soil types. When in doubt about what mixture to use get the recommendation of the state experiment station and visit nearby successful tomato growers and learn their practices.

Fertilizer experiments conducted with tomatoes at the Georgia Coastal Plain Experiment Station indicate that a fertilizer analyzing 5 percent nitrogen, 10 percent phosphoric acid, and 7 percent potash is a satisfactory

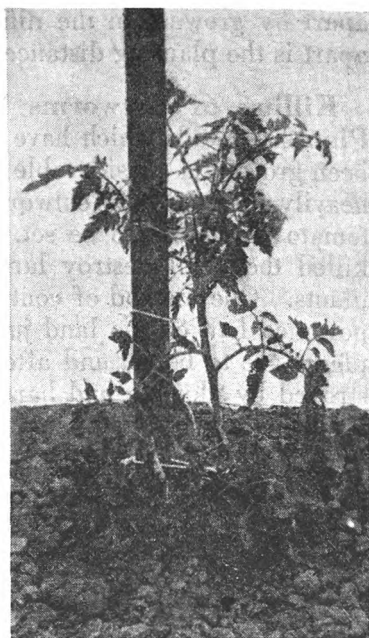
mixture for the representative sandy loam Coastal Plain soils of the lower South. A mixture analyzing 8 percent nitrogen, 8 percent phosphoric acid, and 6 percent potash would be more desirable for the Cecil soils which contain more clay and are located in the Piedmont section of the upper South.

Where no other fertilizers are used, from 700 to 1,000 pounds of commercial fertilizers to the acre are the amounts commonly used on the Coastal Plain soils, while from 600 to 800 pounds to the acre are amounts more commonly used in the Piedmont section.

When and How to Apply the Fertilizer.

—The fertilizer mixture should be applied to the soil some four or five days before setting the plants. If weather conditions are not favorable, however, the fertilizers may be put out at the same time the plants are set. Where 900

pounds or more to the acre are to be used, half should be applied broadcast over the land and the other half put in the drill. An application up to 800 pounds per acre may be all put in the drill. It is very important, however, that fertilizer



YOUNG STAKED TOMATO PLANT
SHOWING THE BEST METHOD OF
TYING TO HOLD THE PLANT SECURE
AND WITHOUT INJURY

applied in the drill be well mixed with the soil. This may be done by running a plow through the furrow once or twice, after the fertilizer has been applied.

Rows for tomatoes may be laid off just as cotton or corn rows are laid off. Some growers use markers which mark off three or four rows at a time. Tomato rows are spaced from three and one-half to five feet apart by growers in the different sections. Four feet apart is the planting distance most commonly practiced.

Killing of Cutworms Before Setting Tomato Plants.—Lands which have been in sod or which have been growing a considerable number of weeds are often heavily infested with cutworms in the spring when the tomato plants are to be set. Unless the cutworms are killed they will destroy large numbers of the tomato plants. One method of controlling the worms is to put poisoned bait on the land just a day or two before the plants are to be set and after all weeds have been destroyed by plowing and harrowing. The following ingredients make a satisfactory bait:

1 peck wheat bran

4 ounces white arsenic or Paris green

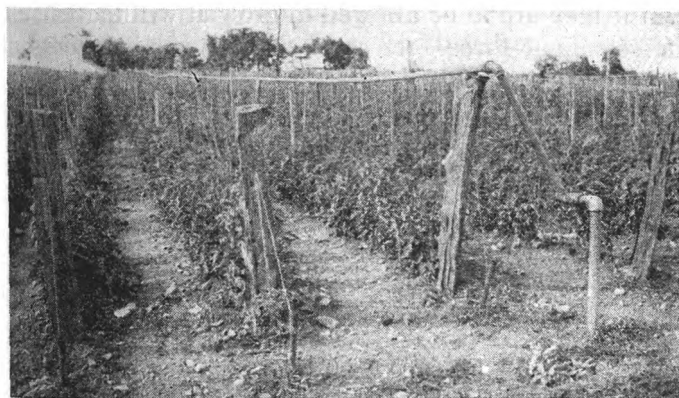
2 quarts molasses

Enough water to make mixture into a stiff dough.

The mixture is made up and strewn over the soil just before sundown so that the fresh poison will be in readiness for the worms when they come out of the soil to feed at night. From one to two bushels of the poison bait should be enough to cover an acre. The amount applied should be varied with the rate of cutworm infestation.

It must be remembered that this poisoned bait will also kill domestic animals if they eat it. The poisoned

land should therefore be carefully guarded until the worms are killed and the remaining poisoned bait harrowed or plowed into the soil.



A FIELD OF TRELLISED TOMATOES SHOWING THE METHOD USED IN TRAINING THE PLANTS AROUND STRINGS

If the bait stays on the soil for two nights it should kill off most of the cutworms present.

Job 4—Setting the Plants

In connection with the job of setting tomato plants in the field it is advisable to keep the following recommendations in mind: (1) plants should not be set in the open until all danger of spring frosts has passed and the soil becomes reasonably warm; (2) well rooted, healthy, stock plants from 8 to 11 inches high are most desired; and (3) they should be so handled during the process of transplanting that their growth is checked just as little as possible. For the last reason, plants which have been transplanted and grown in small pots until the proper size are very desirable.

What Space Tomato Plants Should Have.—As already mentioned, the rows are usually spaced about four feet apart. If the plants are to be pruned and tied to stakes they need be set only about 24 inches apart. But if they are to be allowed to grow at will they should be set about three feet apart in the row. Owners of



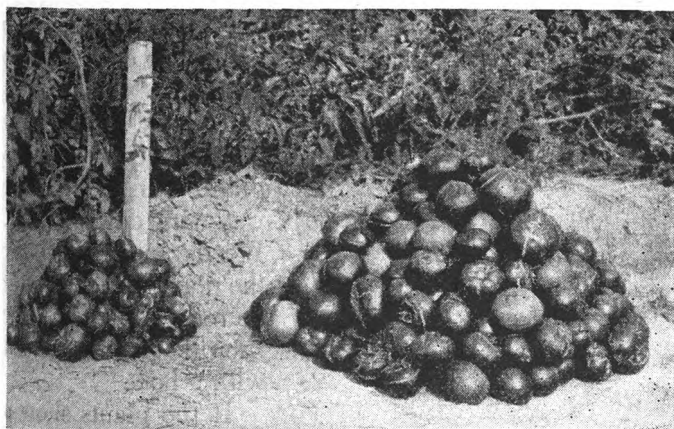
OVERHEAD IRRIGATION PIPES THAT CAN BE UNCOUPLED JUST ABOVE THE CUTOFF VALVE AND MOVED SO THE WATERINGS WILL OVERLAP

small gardens often find it necessary to space their tomato plants much closer than this in order to reserve land for other vegetable crops. Close spacing is not objectionable if the plants are pruned, staked, well fertilized, and kept well watered.

How to Set Tomato Plants.—Tomato plants are most commonly set by hand. Shallow furrows may be run off or holes may be dug with a hoe when the plants are to be set. Unless the soil is very moist, from one-half to a pint of water is poured into the hole or placed in the furrow where the plant is to be set. The root of the plant is placed in contact with the water and the soil raked in from the side with the hand. The plant is set

about two inches deeper in the soil than it stood in the plant bed, and in no case should the plant be allowed to extend more than ten or twelve inches above the surface of the soil. The soil should be firmly pressed around the roots of the plant, but left dry and loose on top.

Tomato plants may be set out with transplanting machines just as sweet potato plants and tobacco plants are



THE EFFECT OF IRRIGATION
Irrigated, *right*; not irrigated, *left*.

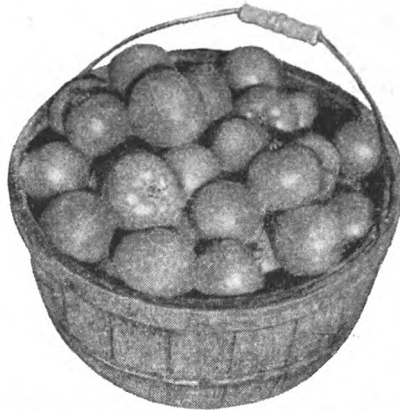
transplanted. However, tomato plants are rather tender and may be expected to do best when set by hand.

Protection from Cutworms.—Often cutworms will remain in the soil even after poisoned bait has been used. The grower can protect his plants against these by tying a paper collar around each plant to the height of three or four inches. Ordinary wrapping paper will serve for this purpose. It should not be wrapped tightly around the plant and should extend into the soil to the depth of about a half inch.

Job 5—Cultivating Tomato Plants

Cultivation should begin about one week after the tomato plants are set to the field or as soon as the roots are well established in the soil. Implements used for cultivating cotton will serve for this purpose. The soil between the rows should be cultivated shallow and frequently. The soil should be cultivated as soon as it

becomes dry enough following each rain to destroy the young weeds and grass. It is best not to cultivate tomato plants while they are wet with dew or rain. Weeds and grass near the plants which cannot be reached by the plow should be removed with a hoe.



Courtesy of Joseph Harris Company, Inc.

THE PAN AMERICAN TOMATO

If the plants show a lack of vigor they should receive a side application of fertilizer about the time they begin to blossom. Nitrate of soda or sulphate of ammonia, applied at the rate of about one hundred pounds per acre, will be found good for this purpose. The fertilizer should not fall on the leaves of the plant, but should be strewn along the row some eight or ten inches from the plants and worked into the soil as it is cultivated. Side applications of fertilizers are needed more on the porous sandy loam soils than on the heavier soils. Some growers have found it profitable to give two side applications of fertilizers in a season.

Where the tomato plants are allowed to grow at will, it will be necessary to stop cultivation when the vines interfere seriously with the plow. But where they are pruned and staked, cultivation may continue until the fruit begins to ripen.

Pruning and Staking Tomato Plants.—A dozen or more methods of pruning and training tomato plants are practiced by growers. Some of the aims sought by all of them are: (1) to keep the fruit off the ground and provide conditions for full development, (2) to induce earliness in ripening, (3) to enable the grower to keep down weeds and grass by tying the plants up to permit cultivation of the soil, and (4) to make spraying the plants and harvesting the fruit more convenient.

One of the most common methods of training tomato plants is to prune each plant to a single stem and tie it to a stake driven into the ground only a few inches from the root of the plant. The side shoots are kept cut off as they appear.

Raffia, strips of cotton cloth, or large soft cord are used for tying the plants to the stakes to prevent injury. When the plants grow to the top of the stakes which are usually about four feet high, they are tied at this point and allowed to hang over as they continue to grow.

Some growers prefer pruning the plants to two stems while others prefer having three main stems to be tied up to the stake.

Plants pruned to a single stem make choice well-formed tomatoes, but they do not produce as many per plant as unpruned plants. The shortage in yield per plant, however, is overcome by setting the plants to be pruned closer together.

Growers of small areas of tomatoes frequently construct novel types of frames and trellises which are too

expensive for large areas. In some instances, however, discarded or waste material can be used for the purpose. Empty banana crates set over the tomato plants make a very desirable support to keep the fruit off the ground. The tomato plant grows up through the crate and hangs over the top.

Discarded, 30-inch, hog wire fencing is sometimes used for training tomato plants. A piece of the fencing the length of the row is stretched horizontally on stakes along the row about a foot above the ground. The plants are allowed to grow up through the meshes of the wire and assume their natural spread on top of it. Sufficient space is left between the strips of wire to allow for horse cultivation and to harvest the fruit. When the crop has been harvested the wire can be rolled up and put aside for the next crop.

Mulching Tomatoes.—Where fine straw, refuse wheat or rye straw, or other similar materials are very plentiful and easy to get, small areas of tomatoes may be mulched. It requires about 15 tons of wheat or rye straw to mulch an acre. Twenty tons of pine straw would be none too much to mulch an acre properly.

A mulch will aid in conserving soil moisture and will prevent the growth of grass and weeds on the land. It also keeps the tomatoes pretty and clean by keeping them off the ground. The practice of mulching is too expensive for use on large areas.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. What implements would you use in preparing the land for tomatoes?
2. Give the steps in preparing the land.
3. When and at what rate should stable manure be applied?

4. At what rates should stable manure to be supplemented by commercial fertilizer be applied?
5. What analysis is recommended for the Coastal Plain section? For the Piedmont section?
6. How do the fertilizer mixtures given in the text compare with those used on tomatoes in your section?
7. Which ingredients of these mixtures furnish nitrogen, potash, phosphoric acid?
8. Where no other fertilizer is used, what amount of commercial fertilizer is recommended for the Coastal Plain section? For the Piedmont section?
9. When should the fertilizer be applied?
10. How should it be applied?
11. At what distance apart should rows for tomato plants be spaced?
12. How are cutworms killed on land before it is set to tomatoes?
13. What three points should be observed in setting plants to the field?
14. Under what conditions are tomato plants set three feet apart? Twenty-four inches apart? Under what conditions are they set even closer?
15. Give in detail the process of setting out a tomato plant.
16. How are the young plants protected from cutworms after they are set?
17. When and how should the plants be cultivated?

SUGGESTED EXERCISES

1. Visit nearby farms and study the methods used for preparing, fertilizing, and cultivating the soil for tomatoes. Compare the fertilizer mixtures used by the grower with those recommended in your text.
2. Record in your notebook the different methods you find for pruning and training tomatoes. Work out from these a method which you believe best for tomato growers of your section to use, and try the method in the home garden.

CHAPTER XL

TOMATOES—INSECTS, DISEASES, AND MARKETING

Job 6—Controlling Insects and Diseases of Tomatoes

Controlling insects and diseases of tomatoes has become necessary in the production of a satisfactory crop. Harmful insects and diseases attacking tomatoes are so generally distributed that the tomato grower cannot hope that his crop may escape severe injury if it is allowed to go unsprayed. Furthermore, weak solutions of copper sulphate, which is the active fungicidal ingredient in bordeaux mixture, stimulate the growth of tomato plants, delay ripening of the fruit, and increase yield, even though no disease may be present.

What Sprays to Use on Tomatoes.—The grower can proceed more intelligently if he knows the habits and life history of each insect and disease attacking his tomatoes and how to combat each successfully. However, this may not be absolutely necessary for one to succeed, for he can follow a regular spray schedule which will give reasonable protection to his plants against a considerable number of both insects and diseases common to the tomato.

The three sprays in most common use by tomato growers are: (1) calcium arsenate, to kill off tomato worms and other leaf and fruit eating insects; (2) nicotine sulphate, which is an extract from tobacco, for killing plant lice and other insects of this class; and (3) bordeaux mixture, which prevents the attacks of a number of leaf and stem diseases.

When prepared separately, these sprays are mixed in the following proportions:

Arsenate of Lead Spray

Calcium arsenate, powdered	1½ lbs.
Hydrate lime	4 lbs.
Water	50 gals.

These ingredients are thoroughly mixed and sprayed onto the plants to destroy leaf and fruit eating insects.

Nicotine Sulphate Spray

Nicotine sulphate, 40%	½ pt.
Fish oil soap or laundry soap	3 lbs.
Water	50 gals.

The soap is chipped finely and dissolved in hot water. It is then made up to 50 gallons with cold water and the nicotine sulphate added. This spray is used to control plant lice.

Bordeaux Mixture

Hydrated lime	5 lbs.
Water	50 gals.
Copper sulphate	4 lbs.

Where it becomes necessary to spray against insects and diseases at the same time, the following combined spray may be used on tomatoes:

Copper sulphate (bluestone)	4 lbs.
Arsenate of lead, powdered	1½ lbs.
Hydrated lime	6 lbs.
Nicotine sulphate	½ pt.
Fish oil soap	3 lbs.
Water	50 gals.

When to Spray Tomatoes.—Tomato plants should be sprayed with bordeaux mixture once or twice in the



A TOMATO PLANT SHOWING BLOSSOM END ROT ON FRUIT
This disease can be controlled by watering the soil.

seedbed before they are set in the field. For this application a weak bordeaux mixture made of three pounds of bluestone, four pounds of lime, and fifty gallons of water should be used.

The first field spraying should be given about ten days after the plants are set in the field. At this time the 4-5-50 or standard bordeaux mixture should be used. Following this the spray with bordeaux mixture should be repeated about every ten days until about one-fourth the fruit has been harvested.

A close watch should be kept for insects. If horn worms or potato beetles begin to attack the leaves, or if the tomato fruit worm starts boring into the fruit, the arsenate of lead spray may be applied or one and one-half pounds of arsenate of lead added to the bordeaux mixture. On the other hand, if plant lice appear in large numbers, apply the nicotine sulphate spray or add three pounds of soap and a half pint of nicotine sulphate to the bordeaux mixture.

In adding arsenate of lead to bordeaux mixture, all that is necessary is to mix enough water with one and one-half pounds of the arsenate of lead powder to make it into a thin paste and stir it into the bordeaux mixture.

The nicotine sulphate and soap are added to bordeaux mixture by chipping finely and dissolving three pounds of soap in a small quantity of hot water, adding one-half pint of nicotine sulphate to the soap solution and then stirring the mixture into the bordeaux mixture.

Dusting as a Substitute for Spraying.—Some of the experiment stations have reported that spraying and dusting have about the same efficiency in the control of insects and diseases of tomatoes. The materials for dusting an acre of tomatoes costs more than those for spraying the same sized area; however, the difference is

probably more than balanced by the extra cost for spray outfits and labor for putting on the sprays.

It requires about 75 gallons of bordeaux mixture, with one and one-half pounds of arsenate of lead added, to properly spray an acre of tomatoes one time.

For dusting an acre, it requires 20 pounds of a mixture made of 64 percent finely screened hydrated lime, 16 percent finely ground dry copper sulphate, and 20 percent calcium arsenate.

Spraying and Dusting Outfits.—Small air-pressure outfits will serve for spraying small areas of tomatoes. Outfits with nozzles attached at the rear of the tank to spray three or four rows at a time are preferable for large fields of tomatoes.

Hand dusters will serve to dust rather large areas of tomatoes.

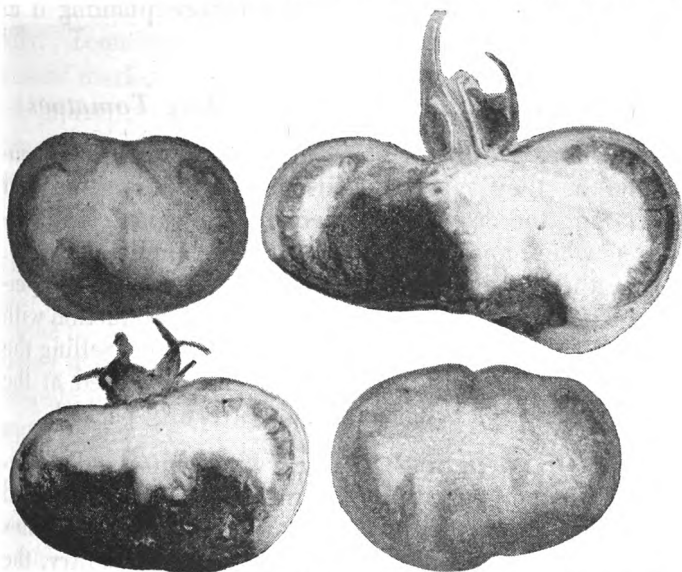
Some Tomato Troubles Which Spraying Does Not Control.—*Fusarium Wilt.*—This disease is commonly called tomato wilt. It winters in the soil and attacks the plants through their roots. The fungus closes the water passages of the plant and causes it to wilt. The brown shown on the inside when an infected plant is split open is one of the identification marks of the disease.

Spraying will not control wilt. Breeding resistant varieties, the production of healthy plants in disease-free beds, and rotating tomatoes with other crops not subject to wilt are the most feasible measures of control.

Blossom-End Rot.—The blossom-end rot is essentially a dry weather disease. The tender cells of the blossom-end of the fruit apparently collapse for the want of moisture. Blossom-end rot is regarded as a physiological trouble, and can be largely prevented by providing a constant supply of moisture in the soil. Irrigating the

soil in dry weather is recommended. Where irrigation is not feasible, mulching the soil with straw and using cultural methods which conserve soil moisture will be found helpful.

Mosaic.—The mosaic disease of tomatoes causes a mottling of the leaves which sometimes slightly roll at



CROSS SECTION OF GREEN TOMATOES HAVING BLOSSOM END ROT

the edges. This is classed as one of the virus diseases since the active organism cannot be seen with a microscope.

The disease is thought to be spread by insects, especially by plant lice. The destruction of diseased plants found in the field, the destruction of weeds attacked by the disease, and the destruction of insects carrying the disease are measures recommended for the control of mosaic.

Nematode.—Tomatoes are very susceptible to the nematode parasite, already described as one of the enemies of the peach as well as many other economic plants. The chief method of control is to provide clean, healthy plants and grow them on soil free of the parasite. Infested land should be planted to resistant crops for three or four years in a crop rotation before planting it to tomatoes.

Job 7—Harvesting and Marketing Tomatoes

Tomatoes grown for home use are harvested and consumed as they ripen. Consequently, harvesting and marketing the crop do not demand the same consideration as where tomatoes are grown on a commercial scale.

For the commercial grower to succeed he must combine economical and efficient methods of production with economical and efficient methods of selling. Selling the crop is greatly simplified if the fruit is picked at the right stage, properly graded, and carefully packed.

Stage of Ripeness to Pick Tomatoes.—For immediate home consumption, tomatoes should be allowed to become almost fully ripe on the vines. If it becomes necessary to save the fruit from attacks of poultry, the tomatoes may be picked when they show the first signs of pink and allowed to ripen indoors.

For the local market tomatoes should be picked when they are from half to fully colored. The stage of ripeness will depend largely upon how far they are to be hauled and how soon they are to be delivered to the consumer after picked. Fully ripe tomatoes do not bear handling well.

Tomatoes for the cannery should be picked just as they are fully colored.

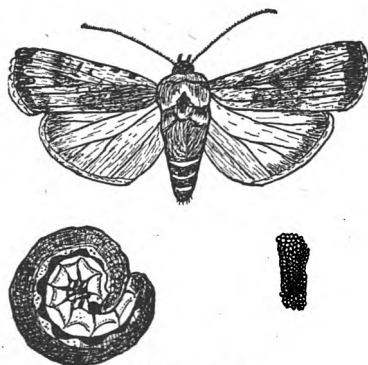
For shipping to distant markets tomatoes should be

picked just before they begin to color. At this stage the blossom-end assumes a whitish-green surface, while a faint brown ring may be observed around the stem cavity. At this stage the seed are sufficiently mature that they will not be cut when the tomato is sliced. With practice, the pickers are enabled to select and pick the tomatoes at the proper stage of development rather rapidly. Tomatoes which are to be graded and packed for distant markets should be handled with the least possible injury, for even a small scratch on the surface may cause the tomato to decay before it reaches the consumer several days later.

Grading Tomatoes.—To sell to the best advantage tomatoes must be properly graded. If not graded in a uniform way the price will be based, in all probability, on the poorer specimens rather than on the intermediate or better specimens.

Only well developed tomatoes which are uniform in size and free from all serious defects should be packed for shipping. The low grade fruit should go for cat-sup making or for some similar use.

There are three colors and three sizes used in grading tomatoes. The colors are: (1) mature green, termed "green warp," which are green when picked but ripen and color in transit and storage; (2) pink, those just beginning to color; and (3) ripe, those which ripen



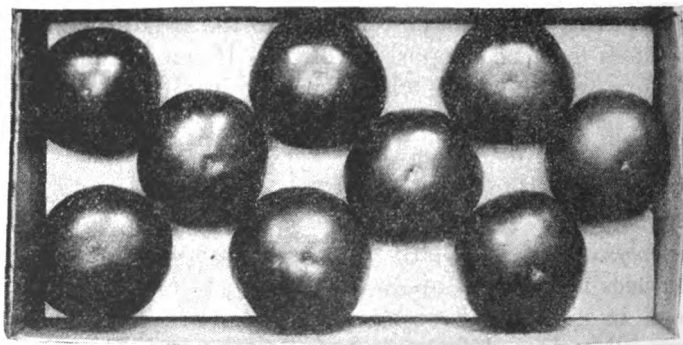
CUTWORM

Eggs, larva, and moth.

on the vines. When packed in six-basket crates, the size grades of tomatoes are termed: (1) fancy, or large; (2) choice, or medium; and (3) gems, or small.

Current specifications for grades of tomatoes are fixed by the United States Department of Agriculture, Washington, D. C., from whom such specifications may be obtained.

How Tomatoes Are Packed for Shipping.—Tomatoes should be shipped in packages that are attractive, inexpensive, and strong enough to protect fruit against injury in transit.



A TEN-POUND PASTEBOARD BOX PACKED WITH MARGLOBE TOMATOES

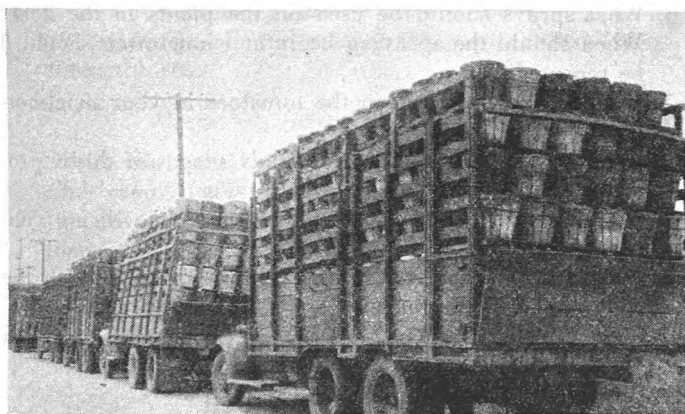
The six-basket carrier, commonly used for shipping peaches, is a package in very general use for shipping tomatoes. The tomatoes are graded, wrapped in tissue paper, and packed in the baskets. Each crate holds six one-gallon baskets. There are a number of other types of crates and baskets from which the grower may choose for shipping his tomatoes.

Less care need be observed in selecting packages for delivering tomatoes to the local markets; however, local

sales are much easier made if the containers are clean and attractive.

Tomatoes are usually delivered to the cannery in boxes holding about a bushel.

How Tomatoes Are Shipped.—Tomatoes picked before they begin to color may be shipped in ventilator cars, while those beginning to turn red should be shipped in refrigerator cars. The number of days the cars are to be in transit will, of course, largely determine the



HAULING TOMATOES TO THE CANNERY

method of shipping. The baskets or crates of tomatoes are packed and fastened in the cars in very much the same way peaches are packed. It is highly important that the containers not be allowed to tumble about in transit.

Selling Tomatoes.—The same general principles observed in selling peaches may be applied in selling tomatoes.

Tomatoes sold to canneries are usually contracted for before the crop is planted and delivered as harvested.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Why is it necessary to spray tomatoes?
2. What three sprays are in common use by tomato growers?
For what is each a remedy?
3. Write each spray on the board and tell how it is prepared.
4. Write the combined spray on the board. When is it used?
5. What spray should be used on the plants in the seedbed?
How often should it be applied?
6. What sprays should be used on the plants in the field?
When should the spraying begin and how often should it be repeated?
7. What sprays are used on the tomatoes in your neighborhood?
8. What are the advantages and disadvantages of dusting tomato plants as compared with spraying?
9. What are the tomato troubles that spraying will not control?
10. What are the characteristics of a plant affected with the wilt? What is the remedy?
11. What are the characteristics of the fruit if affected with blossom-end rot? What is the remedy?
12. How is the mosaic disease spread?
13. What part of the plant is attacked by nematodes? Describe the appearance of that part affected.

SUGGESTED EXERCISES

1. Procure small amounts of spray materials and make up samples of the different spray mixtures recommended for tomatoes in your text. Visit tomato growers and study the types of spray outfits and methods they use for controlling insects and diseases.
2. Make a collection of the insects and diseases you find attacking tomatoes of your community. Those you are unable to name should be sent to your state experiment station or agricultural college for identification.

3. Visit nearby tomato fields and study methods of harvesting the crop. Follow the tomatoes through the packing sheds and note methods of grading, packing, and marketing.

SEASONAL WORK WITH TOMATOES

September, October, and November

1. Select seed from wilt resistant plants for next year's crop.
2. Cultivate young plants which were set in late summer for a fall crop of tomatoes. Harvest and dispose of the fruit from these plants as they ripen.
3. Clean up the stalks from the early planted tomatoes during the early fall and sow turnips, spinach, or kale between the rows.

December, January, and February

1. Secure seed catalogs and order tomato seed for next season's crop.
2. Prepare and lay aside stakes for staking the next crop of tomato plants.
3. Construct or repair hotbed frames and sash preparatory to planting tomato seed in the hotbeds during the latter part of February or about eight weeks before time to set the plants in the open.
4. Provide a good supply of stable manure for heating the hotbeds and a supply of compost soil for them.
5. Provide window boxes if it is desired to start tomato plants indoors.

March, April, and May

1. Sow tomato seed in window boxes or in hotbeds.
2. Thin out the tomato plants and transplant them to other hotbeds when the plants are about two inches high.
3. Keep plant beds and window boxes cultivated, watered, and protected against cold.
4. Harden plants off by exposing them to the open air during mild weather for a week prior to setting them to the field.
5. Fertilize and prepare land for setting tomatoes.

6. Transplant tomato plants to the field only after all danger of spring frost has passed and the soil becomes warm.
7. Begin cultivating and spraying tomato plants in a week or ten days after setting them to the field.

June, July, and August

1. Continue cultivating and spraying tomato plants so as to keep them growing and to protect them against insects and diseases.
2. Prune and stake tomato plants grown in the home garden or for early market.
3. Harvest and dispose of the fruit as it ripens. Continue to spray, prune, and keep the plants tied to the stakes.

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CHAPTER XLI

SWEET PEPPERS—GROWING AND MARKETING

Job 1—Selecting the Land for Sweet Peppers

Sweet peppers comprise those edible varieties of peppers which lack the strong pungent flavor so characteristic of the hot peppers. Of the sweet peppers, the Bell type and the Pimiento type are the most common. In many sections both types are grown in commercial quantities.

Where Peppers Are Grown Profitably in Commercial Quantities.—A few sweet peppers are grown in almost every well planned home vegetable garden. They are grown at a profit on a commercial scale, however, only (1) near large cities or industrial centers which will consume considerable quantities of fresh sweet peppers, (2) near shipping stations for shipping to distant markets, and (3) near canneries where the crop can be sold for canning purposes.

Local Markets.—Very few peppers will supply the small local markets as this product is used more as a relish or condiment than as a staple food. The trucker or vegetable grower supplying local city markets will find it profitable to grow a few acres of sweet peppers along with his other truck crops. He should, however, investigate the demand of his market before deciding upon the amount he will plant.

Land for Growing Peppers for Distant Markets.
—In selecting land from which to ship peppers to dis-

tant markets, the grower should locate near the shipping station to avoid long truck or wagon hauls. He should have productive land that will mature the crop at a time when it will sell at fair prices. Pepper growers in the warmer sections of the South can often grow peppers



SETTING PIMIENTO PLANTS WITH HAND TRANSPLANTERS AND BY HAND

and get them on the market at a time when the northern supply is inadequate to meet the demand.

Growing Peppers for the Cannery.—The growing and canning of Pimiento peppers has become an important industry in a few sections of the South. Before deciding to grow peppers for one of these canneries, the grower must first get a location near enough to haul his peppers to the cannery, which may be as far out as 10 or 15 miles if the roads are good. He should also have

a contract with the cannery to take his crop at a price, agreed upon beforehand, sufficient to return a profit from the money and labor required to produce the crop under normal conditions.

Job 2—Procuring Pepper Plants

The job of procuring pepper plants involves the selection of the variety to be grown. The type of sweet pepper the grower should choose depends upon whether he intends to supply the canneries or sell fresh peppers. For supplying the canneries, the Pimiento peppers are



TWO-ROW TRANSPLANTING MACHINE

preferred. The Perfection Pimiento is by far the leading variety. It is a large, smooth, red, ox-heart shaped pepper with thick, fleshy walls. Well developed fruit of this variety ranges from two to three inches in diameter and often has flesh a fourth of an inch thick.

The Bell peppers are the type commonly sold on the markets for home use. Some of these are larger than the Pimiento but the flesh is proportionately thinner.

The walls of the Bell peppers are more wrinkled and depressed than those of the Pimiento. Some of the leading varieties of the Bell peppers are Royal King, Ruby Giant, and Bull Nose. Of these, the Royal King is probably the leading variety in point of good quality. It is large, fairly smooth, productive, and has thick, fleshy walls.

Growing Pepper Plants at Home.—Peppers, like tomatoes and eggplants, are very sensitive to cold. They also require from 90 to 120 days after sowing the seed before the fruit begins to ripen. For these reasons it is necessary to start the young plants in hotbeds or in some place protected against cold from six to eight weeks before it is safe to transplant them to the field or garden.

Treating Pepper Seed Before Sowing.—Organisms causing several pepper diseases may be carried on



A PIMIENTO PLANT

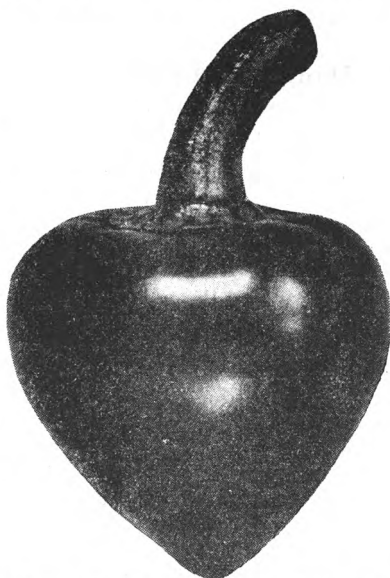
the seed. It is therefore important that the seed be disinfected before they are planted. One of the most satisfactory methods is to soak the seed for 90 minutes in a semesan solution (1 to 400) after which they should be drained and spread out to dry without washing.

How the Plants Are Grown.—The same methods employed for starting tomato plants may be used for starting pepper plants.

A hotbed 6 by 15 feet in size, in which one-third of a pound of pepper seed are sown, should produce enough plants to set one acre. It is well, however, for the inexperienced plant grower to provide about one-third more space than this for each acre as a safeguard against poor stands and accidents of various kinds to his plants.

Growers planting a large acreage to peppers often find it more satisfactory to heat their plant beds with steam pipes rather than with stable manure for the reason that a uniform grade of stable manure is difficult to obtain in large quantities.

Control of Plant Lice in the Plant Beds.—Examine the plants frequently in the plant beds. If plant lice are found on the under surfaces of the leaves, spray



FRUIT OF THE TRUHART PERFECTION
PIMIENTO

thoroughly with a mixture made by adding three teaspoonfuls of nicotine sulphate and four ounces of soap that has been dissolved in a small quantity of hot water, to enough water to make three gallons. If plant lice are on the plants at the time they are taken up for transplanting to the field, the plants may be dipped, root and all, into this nicotine soap solution to free them of the insects.

Damping-Off Disease in the Plant Bed.—Damping-off is a fungus disease which attacks the young plants in the plant bed, causing them to shrivel at the surface of the soil and fall over. This can be partially controlled by the following procedure: (1) space the seed rows four inches apart, (2) water the soil freely and then wait until the surface becomes dry and stir the soil between the rows of plants, and (3) strew half a gallon of air-slaked lime between the rows of each 100 square feet of bed space.

Job 3—Planting Sweet Peppers

It requires a well prepared, fertile soil to produce a satisfactory crop of peppers. A cover crop of vetch or clover should be planted in the early fall on the land on which peppers are to be planted and turned under in the spring. This is especially necessary unless a supply of stable manure is available as it is difficult to grow a large crop of peppers without an abundance of organic matter in the soil.

Where there is no cover crop on the land it may be turned at any time in the winter or early spring that the soil is dry enough to plow. In the early spring the land should be harrowed to smooth it down and break any existing clods.

Laying Off the Rows and Applying the Fertilizer.—The rows are laid off three and a half feet apart with an eight-inch shovel plow. If stable manure is available apply from ten to fifteen two-horse wagon loads per acre in the drill a week or two before the plants are to be set. About 500 pounds per acre of a 4-8-6 fertilizer mixture should be applied with the stable manure.

Where stable manure is not available it is advisable to apply from 600 to 800 pounds of this fertilizer mixture per acre in the drill.

The fertilizers should then be ridged upon with a small shovel plow or some other implement which will serve the purpose.

Fertilizer Mixture for Peppers.—From the limited amount of experimental work done in fertilizing peppers it is believed that a mixture containing about 8 percent nitrogen, 8 percent phosphoric acid, and 6 percent potash is a good general mixture for this crop.

When the plants begin to bloom, a side application of about 65 pounds of sulphate of ammonia or 100 pounds of nitrate of soda or its equivalent in nitrogen has been found helpful.

Setting the Plants to the Field.—Plants on small areas may be set by hand but a two-horse transplanting machine should be used for large fields. These machines have watering devices which water the plants as they are set and in this way provide favorable conditions for the plants to live even when the soil is moderately dry. Plants from six to eight inches high are about the correct size for setting with a transplanter.

The ridged rows three and a half feet apart in which the fertilizers have been applied a week or two before

should be opened deeply with a small shovel plow just ahead of the transplanter.

Spacing Plants in the Row.—Pepper plants require more space on very rich soil than on soil only moderately fertile. The usual practice is to space the plants 20 inches apart on land moderately fertile, and from 24 to 36 inches apart on very fertile soil.

Cultivating the Plants.—Cultivation is started as soon as the pepper plants become well established in the field. This is from ten days to two weeks after they are set. Frequent shallow cultivations should be given to keep down weeds and grass. It is sometimes necessary to cultivate somewhat deeply during the first one or two cultivations after the plants are set to loosen the soil which has been compacted by spring rains. However, if the soil is cultivated deeply enough to break a great many of the lateral roots after the plants begin to fruit, a great many of the blossoms and young peppers will fall off. As a rule, the same frequent shallow cultivations given cotton will be found suitable for peppers.

Job 4—Controlling Insects and Diseases of Peppers

Very few insects, except plant lice, which were discussed under "Control of Plant Lice in Plant Beds" attack peppers. Cutworms, which do some damage to this crop, may be poisoned with the same poison bait recommended for poisoning cutworms attacking tomatoes.

There are a number of diseases attacking pepper plants, but, fortunately, only a comparatively few do serious damage.

Sclerotium Blight.—This disease infects pepper plants in the field as well as a large variety of cultivated

and wild plants. If a diseased plant is pulled up carefully, a white cottony growth of the fungus and small black nodular bodies will be found on the plant just below the surface of the soil. The disease girdles the plant and causes it to wilt.

No method of completely controlling this disease has been worked out. However, the fungus has been found to be more active in acid soils than in alkaline soils. For this reason it is recommended that one and one-half tons of hydrated lime per acre be spread over the land and lightly harrowed into the soil just before the land is laid off for setting the plants in the spring.

It is recommended also that peppers be rotated every year with other crops.

Mosaic Disease.—This disease causes the leaves of the plants to assume a faded mottled color and to become distorted in shape. Plants badly infected with the mosaic disease produce very small and inferior fruit. The organism causing mosaic has never been isolated and identified. It is, therefore, classed as a virus disease. The disease has been known to be spread from plant to plant by aphids and plant lice.

Spraying the plants in the field, as well as in the plant beds, with a nicotine sulphate and soap solution to control plant lice is advised.

Clean culture and the saving of seed from disease-free plants are also good practices towards controlling mosaic.

Leaf Spot and Bacterial Spot of Peppers.—The first of these diseases may be recognized by dark brown spots with pale centers from one-eighth to one inch in diameter on the leaves. The bacterial spot disease attacks the stems, leaves, and fruit, producing circular, raised, wart-like spots.

Spraying with bordeaux mixture has not been entirely satisfactory in the control of these two diseases. Disinfecting the seed at planting time, as has already been described, is thought to be about the best means of control.

Blossom-End Rot.—The blossom-end rot of peppers is similar to blossom-end rot of tomatoes. The disease is very much worse in dry weather and can be largely controlled by maintaining a regular supply of moisture in the soil. It is not generally economical to irrigate pepper fields during dry weather. The grower thus has to depend upon methods of culture and adding humus to his soil to increase its water-holding capacity.

Anthraxnose.—This disease causes a spotting and decay of the fruit. The spots vary from a greenish or golden yellow to a dark brown. They frequently continue to spread until the entire fruit dries up on the plant.

The most effective means of control is to disinfect the seed before they are planted. The method has already been given in connection with planting pepper seed.

Job 5—Harvesting and Marketing the Crop

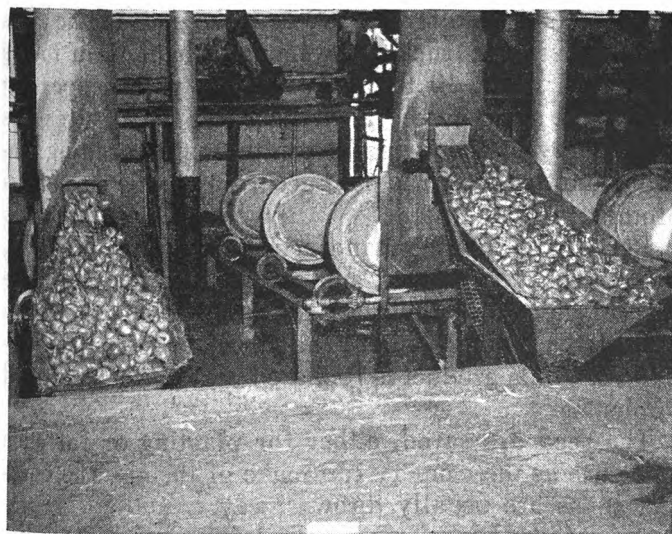
The fruit of a few varieties of peppers turns yellow when ripe, but in most varieties it is a brilliant red.

Bell peppers yield a few more bushels per acre than Pimiento peppers. From three to four tons of either one to the acre is considered a fair yield, even though much larger yields have been recorded.

Harvesting begins as soon as a sufficient number of the peppers ripen to make picking worth while. If the market demands green peppers they are picked as soon as they reach approximately full size and before they

begin turning red. As soon as these peppers are picked they are graded according to size and sent to the markets in baskets, crates, or barrels.

Harvesting Peppers for the Cannery.—Pimiento peppers are practically all used by pepper canneries. The red or ripe, rather than green peppers, are canned. The pepper will remain on the plant in good condition for several days after it ripens. However, the plants continue to bear better if the fruit is kept closely picked.



PIMIENTOS IN HOPPERS AND BEING ELEVATED INTO ROASTERS

The canning plants prefer that the peppers be two inches or more in diameter for canning. Some use the smaller peppers for making catsup, pickles, and relishes. A much lower price is paid for the small fruit.

Peppers are reasonably tough and can be handled with less care than many other crops. Half-bushel peach baskets or ordinary cotton picking bags may be used for

picking peppers. The baskets bruise the peppers less but the picking bags cause no serious injury and enable the picker to harvest the fruit much faster as the bag is strapped across his shoulder and he has both hands free for picking.

Pepper stems are brittle and the picker can easily pick the pods by giving them a sharp twist. It is easy enough for one person to pick 2,000 pounds of peppers a day.

As the peppers are picked they are either poured out onto sheets or into large baskets at the ends of the rows in readiness for trucks or wagons to haul them to the cannery. From 40 to 60 bushels of ripe peppers in bulk make a two-horse wagon load. As the load reaches the cannery the peppers are run through a grading machine and the grower is paid according to the size of his product.

Peppers go into the manufacture of various products, such as relishes, pickles, and catsup. However, a large percentage of the canneries skin and can only the fleshy part of the pepper without the admixture of other substances. This product is found on the market as canned Pimientos.

The seed are saved, either for planting or for such other use as the cannery can make of them. The cores and stems are usually thrown away.

An average bushel of ripe Pimiento peppers, as delivered to the cannery, weighs 33 pounds. Of this weight there are 22.68 pounds of pulp or flesh used for canning, 5.15 pounds of cores, 2.06 pounds of stems, and 3.09 pounds of seed.

An average bushel of ripe Bell peppers weighs 26.75 pounds. Of this, there are 22.12 pounds of pulp or fleshy part, 3.25 pounds of cores, 1.50 pounds of stems, and .88 pound of seed.

Hot Peppers.—The culture of hot peppers is essentially the same as for sweet peppers. Hot peppers are frequently grown on a commercial scale and used for pickling, as well as for various relishes. Both the sweet and the hot peppers have a place in the home vegetable garden.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. What two types of sweet peppers are grown?
2. When are peppers grown profitably in commercial quantities?
3. Why should local truckers investigate the demands of their markets before planting more than an acre or two to peppers?
4. What two points should the grower investigate before deciding to grow peppers for a cannery?
5. What kind of soil is suitable for peppers?
6. For what is the Perfection Pimiento pepper used in this country?
7. What is the most popular variety of the Bell peppers?
8. What is the difference in appearance between the Pimiento and Bell peppers?
9. What size and type of pepper plants should be provided by the grower?
10. In the Piedmont section of the South why is it necessary to start pepper plants in a hotbed? When should the seed be planted?
11. What size hotbed and what quantity of seed are required to grow enough plants to set one acre of land?
12. How should the seed be treated before planting? Why?

SUGGESTED EXERCISES

1. Visit the pepper farms of your community to study the growers' methods of preparing soil, fertilizing, and growing peppers. Get records of the comparative cost of grow-

ing pepper and cotton and determine which returns the greatest net profit.

2. Study the types of plant beds used for starting plants in your community and figure the cost of their structure and maintenance. From the cost figures you get, determine whether it is more economical for the grower to purchase his plants or to grow them at home.
3. Make a study of the implements used for transplanting and cultivating peppers. Determine which of these can be used for other crops as well as peppers. Transplant some pepper plants by hand and compare with those transplanted with a machine, for the purpose of seeing which lives and grows best.

SEASONAL WORK FOR PEPPERS

September, October, and November

1. Continue to harvest and market the fruit until the plants are killed by frost.
2. Save planting seed from prolific, disease-free plants.
3. Sow seed for a cover crop of vetch or clover at the last cultivation of the plants in September or October.

December, January, and February

1. Procure pepper seed and make germination tests of them.
2. Prepare hotbeds and sow pepper seed from six to eight weeks before spring opens.
3. Select the land for the next crop of peppers, terrace if rolling, and remove stumps or other impediments to cultivation.
4. Procure fertilizers and get equipment in readiness for spring work.

March, April, and May

1. Plant pepper seed in hotbeds if they were not started in February.
2. Prepare and fertilize the pepper fields.

3. Set the plants to the field as soon as the plants are well established in the fields.

June, July, and August

1. Continue to cultivate plants in the field.
2. Give side application of fertilizer if plants show lack of vigor.
3. Provide picking baskets or sacks and hampers or crates for shipping if the crop is to be shipped.
4. Begin harvesting and marketing the peppers when they are ready.

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CHAPTER XLII

IRISH POTATOES—GROWING AND MARKETING

Job 1—Selecting the Land for Irish Potatoes

The commercial importance of the southern crop of Irish potatoes is due to the fact that it can be matured early and put on the northern markets as "new potatoes" in the late winter and early spring. These potatoes usually bring remunerative prices when sold in competition with the previous year's crop grown in the North.

However, the low yield to the acre of Irish potatoes in the southern states offsets somewhat this higher price for a bushel. This can be seen by comparing the yields in the northern states bordering the country from Maine to Minnesota with a group of states on the southern border extending from North Carolina to Texas.

YIELD PER ACRE IN BUSHELS *

State	1937	1938	1939	State	1937	1938	1939
South Carolina.	116	115	111	Maine.....	267	242	225
Florida.....	110	132	120	New Hampshire	153	135	150
North Carolina.	100	110	100	Vermont.....	136	120	130
Alabama.....	81	103	108	New York.....	123	122	127
Mississippi....	72	72	71	Michigan.....	92	120	97
Texas.....	66	59	62	Wisconsin.....	88	90	88
Georgia.....	65	68	77	Minnesota.....	77	90	85
Louisiana.....	62	64	54				

* From 1940 Yearbook, United States Department of Agriculture.

It will be observed that the group of southern states as a whole produces hardly three-fourths as many potatoes to the acre as the group of northern states. In addition, the costs of growing the crop in the South is

increased by the use of from two to three times as much commercial fertilizers to the acre as is practiced in the North. The cost of the seed potatoes which the southern grower has to buy each year must also be considered for the northern grower can grow his own seed.

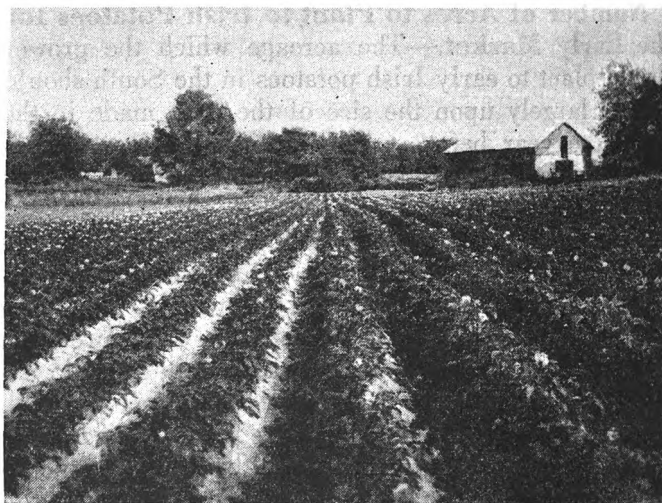
Number of Acres to Plant to Irish Potatoes for the Early Market.—The acreage which the grower should plant to early Irish potatoes in the South should depend largely upon the size of the crop made in the North the year before. This information can be obtained from the October crop reports of the United States Department of Agriculture.

If there is a large crop of Irish potatoes in storage in the North, it is not likely that early southern-grown potatoes will bring a high price the following spring. The northern consumer will pay about the same premium each year for new potatoes from the South over old potatoes held in storage in the North. Consequently, when the storage potatoes in the North are plentiful and cheap the new potatoes from the South will bring a correspondingly low price on the market. A short northern crop should be followed, therefore, by the planting of a large southern crop.

The Irish potato is such a heavy yielding crop, averaging from 100 to 200 bushels to the acre, that the grower can ship his crop in carload lots from areas even as small as five to ten acres.

Land for Growing Potatoes for Local and Distant Markets.—Irish potatoes can be made a chief money crop if grown near large cities and manufacturing centers for supplying the local markets. It may be grown on a much larger scale, however, if the plantings are located convenient to shipping points from which the crop can be shipped in carlots to distant markets. The

Irish potato is not so quickly perishable as a number of our common fruits and vegetables. However, when the crop is harvested before being fully matured, which is the usual custom in the South, it should be put on the market promptly.



IRISH POTATO FIELD IN FULL BLOOM

Type of Soil Suitable for Potatoes.—The Irish potato requires a fertile, well-drained soil, which contains large quantities of humus or organic matter. The stiff clay soils and deep porous sandy soils are less desirable than the intermediate loams. The early crop grows off quicker and suffers less from frost injury if planted on the sandy loam soils than when grown on the low mucklands.

Job 2—Procuring Seed Potatoes

Only a small percentage of the southern planters grow and save their own seed Irish potatoes. This prac-

tice is followed for two reasons: first, the early crop of southern-grown potatoes does not keep well in storage through the long hot summers; and second, the crop has a tendency to mature later when the seed potatoes are produced in the South.

The general practice is to buy the seed potatoes from the North and Middle West each year. In recent years, however, the growing of seed Irish potatoes has been successful in several sections of the South, notably north Georgia, western North Carolina, east Tennessee, and a few other mountainous or elevated sections. For many years the second or late crop of Irish potatoes grown on the east shore of Maryland and Virginia and in sections of Oklahoma and Arkansas have been held over for planting the following spring. These have given excellent yields when used for spring planting but do not mature the crop quite as early as seed potatoes shipped in from the North.

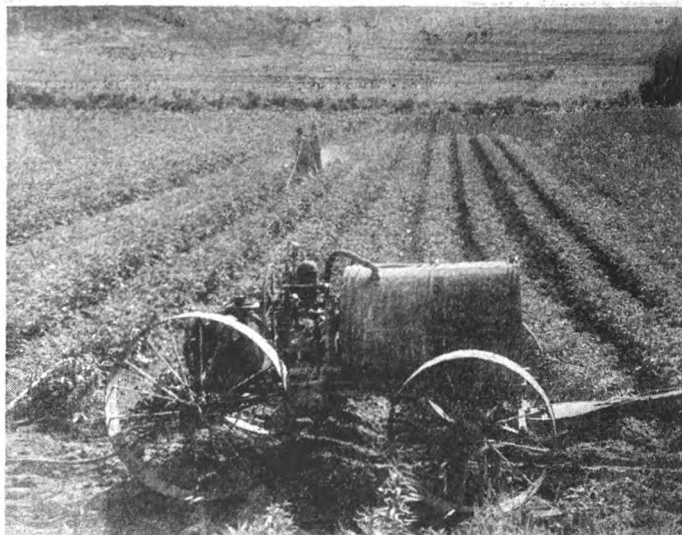
The growing of seed Irish potatoes is an important industry in many of the northern and western states. For a long time, Maine-grown seed potatoes were most popular in the South. In recent years the industry has spread westward. Wisconsin, Minnesota, Nebraska, and the Dakotas are now some of the exporting seed-producing states.

Certified Seed Irish Potatoes.—Certified seed Irish potatoes are those which measure up to definite standards of type and are free from disease as certified to by authorized field inspectors.

The group of diseases which the inspectors try to eliminate in the production of certified seed stock are known as virus diseases.

Mosaic, which produces light and dark green patches on the leaves more or less vaguely outlined; leaf-roll,

which causes an upward rolling of the leaves; streak, which causes streaking, spotting, and leaf-dropping; spindle-tuber, which causes the plants to produce under-sized potatoes with pointed ends; and curly-dwarf, which causes the curling of the foliage and dwarfing of



SPRAYING IRISH POTATOES IN NORTH GEORGIA

the plants; are common manifestations of this group of diseases.

These diseases are caused by undetermined organisms which live in the sap of the plants and tubers, and may be transmitted from the seed pieces planted to the young plants sprouting from them. Plant lice and other insects may spread such diseases from one plant to another in the field during the growing season. Spraying to control the insects may lessen the spread of these virus diseases; otherwise spraying has no influence toward their control. Selection of fields of plants free of

virus diseases is the most feasible method of producing desirable seed Irish potatoes. A grower who produces certified seed stock has his field inspected two or three times during the growing season by a state inspector. The first inspection is made when the plants are about six inches high. At this time all plants which are diseased or otherwise abnormal in appearance are pulled up and destroyed. The field is inspected at least one other time, preferably when the plants are in bloom. At that time stray plants of other varieties than the one planted can be detected and destroyed, as well as all diseased plants. In addition to the inspection, the plants are sprayed to control other diseases and insects. If the grower succeeds in maturing his crop free of the virus diseases, he is given a certificate by the inspector which permits him to sell the crop as certified seed.

Certified seed Irish potatoes sell at a premium above ordinary seed stock, but will usually more than justify the extra cost through increased yields.

Varieties to Buy.—The varieties most commonly grown in the South for the early market are Irish Cobbler; Bliss Triumph, also called Red Bliss; and Spaulding No. 4, frequently called Spaulding Rose No. 4. The Irish Cobbler is more extensively planted than any other one variety, especially along the Atlantic Coast from New Jersey southward, as well as in Kentucky and Alabama. The Triumph is planted in south Florida and the Gulf Coast region as well as in Tennessee.

Spaulding No. 4 is generally grown in the Hastings district of Florida and to some extent in Louisiana. These are all early varieties and enables the growers to get their crops on the market early in the season.

The Katahdin and Green Mountain varieties are used most commonly for growing the fall crop along

the southern border of the Appalachian Highlands, extending from Virginia through western North Carolina, northern Georgia, eastern Tennessee, and northern Alabama.

Where to Buy Seed Irish Potatoes.—The United States Department of Agriculture, state experiment stations, and agricultural colleges can put growers in communication with producers of good seed Irish potatoes.

Job 3—Planting Irish Potatoes

Where the land is somewhat flat, drainage is improved by breaking the land in strips from 20 to 30 feet wide and leaving deep water furrows between the strips. Drainage is further accomplished by breaking the land twice, each time throwing the soil toward the center of the strip with the plow.

On ordinary well-drained soils, plowing the land into narrow strips for drainage is unnecessary. All that is necessary in preparing these soils is to break the land broadcast and harrow it down smoothly before laying off the rows for planting. The land should be broken from six to nine inches deep, three or four weeks before the crop is to be planted. Just a few days before planting time the soil should be harrowed, the rows laid out, and the fertilizers applied.

Fertilizing Irish Potatoes.—A fertilizer containing 8 percent nitrogen, 8 percent phosphoric acid, and 6 percent potash is considered desirable for Irish potatoes when planted on the sandy loam soils commonly used for this crop. Growers usually desire that one-half of the nitrogen in the fertilizer mixture be derived from such quick acting materials as nitrate of soda and sulphate of ammonia, and the other half from the more slowly available materials such as fish scrap, tankage,

and dried blood. From 1,000 to 1,200 pounds of fertilizer to the acre are quantities commonly used, while the growers in some districts apply as much as a ton to the acre.



A PLOW FOR HARVESTING POTATOES

Treating Seed Irish Potatoes Against Disease.— Seed Irish potatoes frequently carry spores of disease on the surface which can be killed by soaking in disinfectant solutions. It is best to treat the seed potatoes

before they are cut. Either of the solutions given below may be used.

Corrosive Sublimate Solution.—Dissolve two ounces of corrosive sublimate in one gallon of hot water, and add 15 gallons of water. The potatoes are soaked in this solution for one and one-half hours if they have not begun to sprout. If sprouting has begun they should be soaked only thirty minutes. When removed from the solution they should be spread to dry before they are cut and planted.

Formaldehyde Solution.—Add one pint of 40 per cent formaldehyde solution to 30 gallons of water and soak the seed potatoes in this solution for two hours if not sprouted or one hour if slightly sprouted. They should then be spread to dry.

Cutting Irish Potatoes for Planting.—Irish potatoes are cut in pieces varying from one to one and one-fourth ounces each. Each piece should contain one or two eyes. The cutting should not be done until just before the potatoes are planted. If the seed pieces are rolled in air-slaked lime or sulphur as soon as cut, the surface will dry much quicker and prevent the loss of moisture. It requires from ten to thirteen bushels of seed Irish potatoes to plant an acre when the seed pieces are cut in this manner.

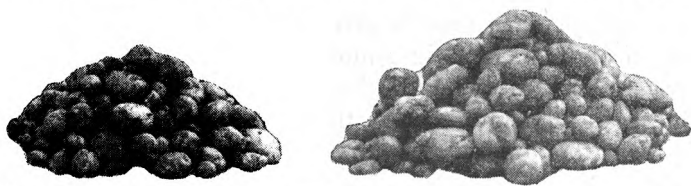
Laying Off the Rows and Planting.—Irish potatoes for the early crop are planted some five or six weeks before the last spring frost is expected. Those for a fall crop should be planted in midsummer or about 120 days before frost comes in the fall.

The rows for Irish potatoes may be spaced from 30 to 36 inches apart. The seed pieces are dropped from 14 to 18 inches apart in the row. It is customary to drop

the seed pieces in the bottom of the furrow and cover them to the depth of five or six inches by ridging the soil over the furrows. The seed pieces may be dropped by hand or they may be planted with a horse-drawn planting machine. Some of these planting machines have a fertilizer attachment which enables the grower to put in the fertilizer, plant, and cover the potatoes all in one operation.

Cultivating the Plants.—Cultivation should begin as soon as the danger of frost is past and the plants begin to push through the surface of the soil. Some growers run a broad drag over the ridges first. This helps to break the crust on the soil and enables the plants to come through. Following this, the first cultivation should be deep to provide conditions favorable for tuber development. From this on, shallow cultivations are given to keep down weeds and grass. On flat lands where the crop is planted on high ridges to give drainage, the two-horse disk cultivator is a satisfactory implement for cultivating the crop. The inner disks are set higher than the other ones in order that the bottom and sides of the beds may be cultivated at the same time. The cultivation is continued until two or three weeks before harvesting the crop.

Crop Rotation.—Crop rotation is as important for Irish potatoes as for other crops. Irish potatoes should



COMPARATIVE YIELD OF IRRIGATED (*right*) AND NON-IRRIGATED (*left*)
IRISH POTATOES FROM SAME SIZE PLOT

not be planted on the same soil year after year, for such a practice not only tends to increase the diseases and insect pests of the crop, but it depletes the fertility of the soil. Growing Irish potatoes in rotation with such crops as corn, velvet beans, cowpeas, and others which add vegetable matter to the soil is generally practiced.

Controlling Diseases and Insects.—Aside from the virus diseases already mentioned, the early blight, late blight, potato beetle, and plant lice are the diseases and insects which commonly attack Irish potatoes. Of these, the late blight rarely does serious damage in the South. The early crop of Irish potatoes generally grown in the South matures so quickly that the regular spray schedule recommended for the northern states is unnecessary. For the lower South two spray applications will usually be sufficient while three or possibly four are sufficient for the upper South. It sometimes becomes necessary to give an additional application where the spray is washed off by frequent rains or where the attacks of insects and diseases are unusually severe.

Bordeaux mixture and arsenate of lead are the sprays recommended for Irish potatoes. Four pounds of bluestone, five pounds of lime, two pounds of powdered arsenate of lead, and fifty gallons of water are satisfactory proportions. If plant lice are found on the plants, a half pint of nicotine sulphate should be added to each fifty gallons of the bordeaux-arsenate of lead mixture. The first spray application is given when the plants are from six to eight inches high, and the second is given about three weeks following the first. In the event of a sudden outbreak of potato beetles, they may be held in check by dusting the plants with calcium arsenate.

Harvesting and Marketing the Crop.—Irish potatoes for the early market are harvested before they are

fully mature. As a rule, those that reach the market first bring the best prices. For this reason harvesting begins just as soon as the tubers reach marketable size and are sufficiently mature for the skin to slip if pressed on the surface with the thumb. The early crop is usually harvested from 80 to 90 days after planting.

Irish potatoes grown for seed purposes should be allowed to mature fully in the field. This is indicated by the dying of the vines which occurs about 120 days after planting.

Grading Potatoes.—Some of the smaller growers grade Irish potatoes by hand as they are picked up. The common practice is to use a potato grader which divides them into three sizes: No. 1, No. 2, and No. 3. No. 1 and No. 2, which are the larger sizes, are easily sold in the markets. However, there is little demand for No. 3's unless Irish potatoes are very scarce. But the grower who desires to sell his Irish potatoes according to the standard grades accepted in any part of the country had best follow the specifications for grading as established by the United States Department of Agriculture and published in Circular 96. They are as follows:

United States Grade Fancy

This grade shall consist of sound potatoes of one variety which are mature, bright, smooth, well shaped, free from dirt or other foreign matter, frost injury, sunburn, second growth, growth cracks, cuts, scab, blight, soft-rot, dry-rot and damage caused by disease, insects or by mechanical or other means. The range in size shall be stated in terms of minimum and maximum diameter or weight following the grade name, but in no case shall the diameter be less than two inches.

In order to allow for variations incident to commercial grading and handling, five percent by weight of any lot may vary from the range in size stated and, in addition, three percent

by weight of any such lot may be below the remaining requirements of this grade; but not more than one-third of such three percent, that is to say, not more than one percent by weight of the entire lot may have the flesh injured by soft-rot.

United States Grade No. 1

This grade shall consist of sound potatoes of similar varietal characteristics which are practically free from dirt or other foreign matter, frost injury, sunburn, second growth, growth cracks, cuts, scab, blight, soft-rot, dry-rot, and damage caused by disease, insects, mechanical, or other means.

The diameter of the potatoes of the round varieties shall not be less than one and seven-eighths inches, and of potatoes of long varieties, one and three-fourths inches.

In order to allow for variations incident to commercial grading and handling, five percent by weight of any such lot may be under the prescribed size, and, in addition, six percent by weight of any such lot may be below the remaining requirements of this grade; but not more than one-third of such six percent, that is to say, not more than two percent by weight of the entire lot, may have the flesh injured by soft-rot.

United States Grade No. 2

This grade shall consist of potatoes of similar varietal characteristics which are practically free from frost injury and soft-rot and which are free from serious damage caused by sunburn, cuts, scab, blight, dry-rot, or other disease, insects, mechanical, or other means.

The diameter of potatoes of this grade shall not be less than one and one-half inches.

In order to allow for variations incident to commercial handling and grading, five percent by weight of any lot may be under the prescribed size, and, in addition, six percent by weight of any such lot may be below the remaining requirements of this grade; but not more than one-third of such six percent, that is to say, not more than two percent by weight of the entire lot, may have the flesh injured by soft-rot.

Packages for Shipping Irish Potatoes.—The earliest Irish potatoes from Florida are shipped frequently in bushel hampers. However, the slatted barrel, holding nine pecks, is a package in more general use. After the barrels are filled, the tops are covered with strong burlap which is held in place by a strong, stout hoop. Some growers ship their early crop of Irish potatoes in bags, but they are bruised more in handling by this method than when shipped in barrels. One hundred bushels of early Irish potatoes to the acre is considered an average yield even though much larger crops can be produced under favorable conditions.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Upon what should depend the number of acres a southern grower plants to potatoes?
2. What type of soil is suitable for potatoes?
3. Why do not southern growers grow and save their own seed potatoes?
4. What are certified seed Irish potatoes?
5. What are the popular varieties of Irish potatoes grown in the South?
6. What preparation should be given the soil before planting Irish potatoes?
7. What and how much fertilizer is recommended for Irish potatoes?
8. Why should seed Irish potatoes be treated before being planted?
9. What methods of treatment are recommended?
10. How should the potatoes be cut for planting?
11. What is the advantage of rolling the pieces in air-slaked lime?
12. How many bushels of seed Irish potatoes are required for planting an acre?

SUGGESTED EXERCISES

1. Visit successful Irish potato growers in your community and study the soil types which give them the best yields. Study also their methods of fertilizing, cultivating, harvesting, and marketing the crop.
2. Collect samples of the leading varieties of Irish potatoes grown in your section and learn to identify each.
3. Get yield records with figures on cost of growing Irish potatoes in your community and compare these with yields and costs of producing other crops, in order to determine the importance of the Irish potato as a money crop in your locality.

SEASONAL WORK WITH IRISH POTATOES

September, October, and November

1. Cultivate and spray the fall crop of Irish potatoes.
2. Harvest the crop as soon as it is matured or when the plants are nipped by frost.
3. Plant a cover crop on the land, or some winter vegetable, as turnips or spinach, as soon as the potatoes are harvested.

December, January, and February

1. Study the crop reports of the United States Department of Agriculture and learn the amount of Irish potatoes on storage in the North before deciding how many acres to plant.
2. Procure seed potatoes, fertilizers, and spray materials for making the next crop.
3. Prepare soil and begin planting in the lower South.

March, April, and May

1. Plant Irish potatoes in the upper South and begin cultivating as soon as the plants are well up.
2. Make preparations and begin spraying as soon as the plants are large enough.

3. Procure packages for marketing the crop and keep in close touch with the markets.

June, July, and August

1. Harvest and market the crop when it is ready.
2. If the market becomes glutted, place the crop on cold storage until the demand increases.
3. Plant a fall crop if the region is adapted to growing Irish potatoes in the fall.

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CHAPTER XLIII

THE HOME VEGETABLE GARDEN

Job 1—Selecting the Land for the Home Vegetable Garden

Every home should have a garden. Especially is this true of the farm home for the reason that no other source of fresh vegetables is at hand, and no diet will long sustain health that does not contain a rather generous proportion of green vegetables. Moreover, the larger part of the food supply can be produced in the garden, thus reducing the family expenditures, and thereby in reality increasing the income. Not only should a supply of vegetables for the summer months be produced, but also enough for canning to meet the family needs until the garden comes into production the following spring. Often a surplus over and above the family needs can be sold easily at a nearby market.

In selecting the land for the home garden there are two important questions to consider: first, where to locate the garden; and second, how much land to devote to it. Usually convenience is a more important factor in locating the garden than the soil type. For that reason, ordinarily, a location adjacent to the house is selected. The size of the garden must be determined by the quantity of produce that will be required to meet the family needs, the amount of labor that can be devoted to it, and the possibility of easily selling any surplus that may be produced.

Soil Type to Select.—Most vegetable crops grow best on a well-drained, fertile, sandy loam soil. It



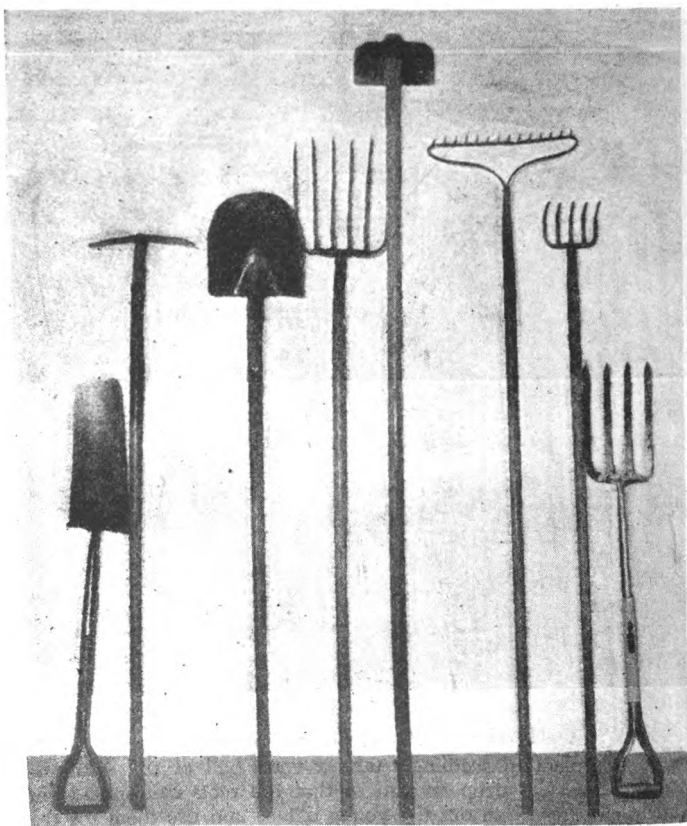
Courtesy of Ferry-Morse Seed Company

HINTS FOR PLANTING VEGETABLES

Top, in transplanting seedlings, take a good ball of soil with the roots. Dig the holes deep enough so that the roots can spread out naturally. *Center*, Thin out the young onions and use them for the table. *Bottom*, After the plants are grown, cultivate less deeply than at first to avoid injury to the roots.

sometimes becomes necessary to use heavy clay or poorly drained soils in order to have the garden near the home.

Heavy soils may be made light and friable by adding large quantities of screened coal ashes, sand, or compost. The coal ashes contain very little plant food, but are very satisfactory to lighten heavy soils where a coating an inch or two thick can be spread over the soil and



USEFUL GARDEN TOOLS

plowed under. Air-slaked lime, applied at the rate of two tons to the acre, will assist also in making stiff soils more easily worked.

Poorly drained soils may be drained with tile or by means of open ditches. In flat countries, where quick drainage is difficult, it often becomes necessary to plant a number of the vegetable crops in broad ridges or beds so that immediately after rains excess water can drain into the furrows between the rows.

The home vegetable garden usually covers such a small area that a great deal more time and expense can be devoted towards getting the soil into a suitable condition to grow vegetables than would be justifiable on large areas of lands for our principal farm crops.

Fencing the Garden.—In communities or on farms where poultry is allowed to run at large, it is necessary to fence the garden with poultry wire. This fence frequently serves the double purpose of excluding poultry and as a trellis for pole beans.

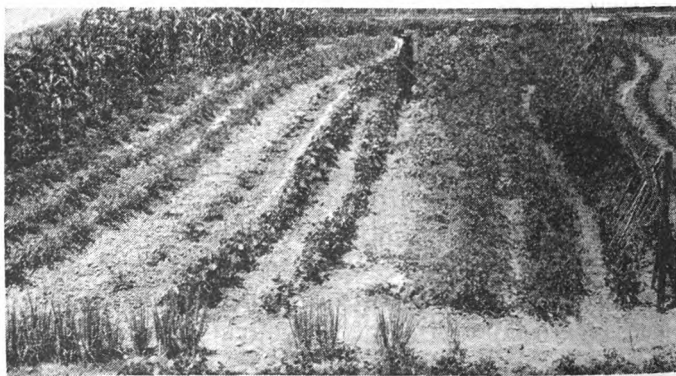
Size of Garden.—Home vegetable gardens vary in size from half an acre or more on the large farms where land is plentiful to only a few square feet on some of the small town and city lots.

Where cantaloupes, watermelons, and sweet potatoes are grown outside of the vegetable garden, which is the practice on most farms, a space 80 feet by 150 feet, a little more than one-fourth of an acre, should be sufficient for an average family. If there is a ready sale for surplus vegetables a larger area could be planted to good advantage. It should be remembered that where labor is scarce, there is danger in attempting to plant too much, for a small garden well tilled will produce more than a large garden neglected.

Gardens Need Sunlight.—It sometimes occurs that small areas between buildings, near tall board fences or trees are not suitable for gardens because the sunlight is obstructed. Plants grown for their leaves, such as lettuce, mustard, spinach, and some varieties of turnips, will make fair crops with only three or four hours of sunlight each day. However, crops grown for their fruit, such as okra, eggplant, tomatoes, and pepper, should have considerably more than this.

Garden Tools.—Necessary tools for taking care of the vegetable garden will be needed also in taking care of the shrubbery and ornamental plant beds about the home. It is usually necessary on the average farm to buy very few tools, especially for this work, as the general farm tools can be made to serve. A garden line, used for marking out straight rows, a steel rake, and a hand plow to cultivate a few rows of vegetables when the mule and plow are otherwise occupied are about all the additional implements necessary for taking care of the farm vegetable garden.

The seed drill is a useful implement to the market



A HOME VEGETABLE GARDEN

gardener, but is seldom needed in the home vegetable garden. Here the small amount of seed of a kind commonly planted can be done in less time by hand than it would take to clean out and adjust the seeder when changing from one kind of seed to another.

For a garden too small for horse cultivation, the following list of tools will be found useful:

One hand plow	One spade
One steel rake	One prong or potato hoe
One No. 2 hoe	One mattock
One pitchfork	One garden line
One round-pointed shovel	Small hand trowels

Small hand weeders can be added to this list of tools if desired. This list may be purchased at a cost ranging from \$15 to \$20, depending upon the grade. In cases where it is necessary to reduce the cost of implements to a minimum, a small garden can be worked with a hoe, rake, and spade.

Job 2—Procuring Seed and Plants

Procuring good seed is one of the most important jobs connected with successful vegetable gardening. Where the gardener has sufficient interest in seed selection and plant breeding, a considerable portion of his garden seed may be grown and saved at home. However, it should be remembered that only certain kinds of seed can be grown successfully in any one part of the country, and that no section is suitable for growing all kinds of seed. Your experiment station will be able to advise whether or not any particular kind of garden seed can be grown in your section. In most sections of the South, seed of asparagus, beans, collards, cucumbers, eggplants, cantaloupes, okra, peas, peppers, squash, sweet corn, and watermelons can be successfully grown. To-

mato seed can also be saved from southern gardens even though the plants have a tendency to grow larger and become less prolific when seed are grown under southern climatic conditions for three or four years in succession.

Selecting and Buying Seed from Seed Houses.

—Most seed houses issue their seed catalogs in early winter. This gives the gardener sufficient time to look over the list and order the varieties in the amounts that he needs. It is an unwise practice to postpone buying the seed until time to begin planting. Under such conditions, the gardener is apt to rush to the nearest groceryman or drug store and take varieties and a grade of seed which may be unsuited to his conditions. It is far better to select carefully, well in advance of planting time, the desirable grades and varieties and place an order with a reliable seedsman for the full amount of seed needed for the entire year.

Quantity of Seed the Gardener Should Procure.

—One satisfactory method of determining the amount of garden seed that will be needed is to draw a plan of the garden and decide how much space is to be devoted to each vegetable. This is a question which must be decided by each family. Where one family may desire a large area devoted to tomatoes and corn, some other family might prefer a larger percentage of beans and onions.

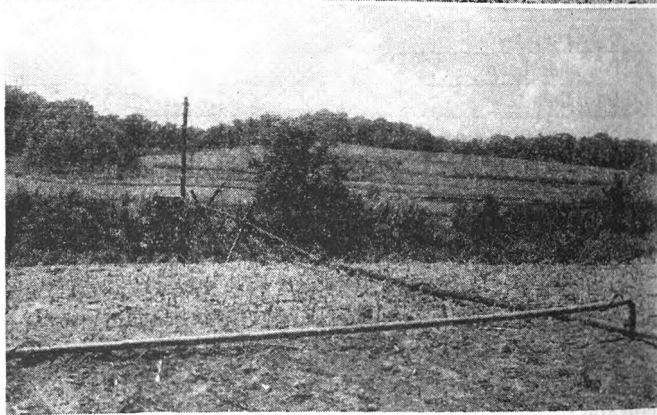
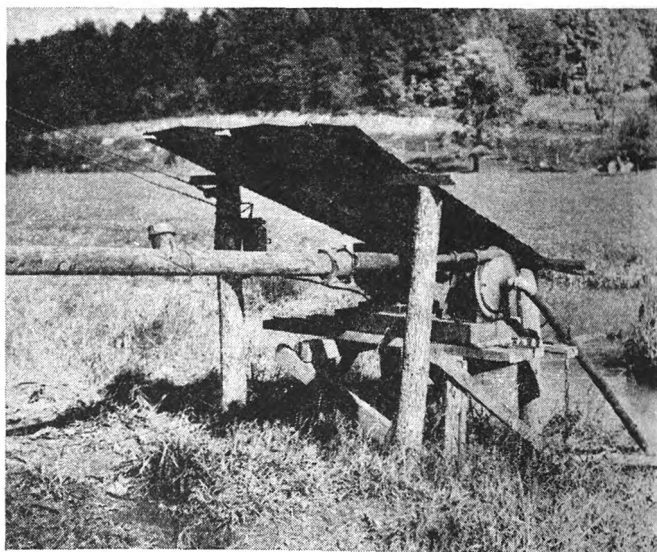
Plan of Garden.—Below are given plans for two gardens with estimated quantities and suggested varieties of seed for planting each. The first is a garden 150 by 80 feet, planned to be prepared and cultivated with a mule and plow. The other is a garden only 25 by 30 feet, adapted more for a town or city back yard. It is to be prepared and cultivated entirely by hand.

PLAN OF GARDEN 80 BY 150 FEET.
(To be cultivated with horse and plow.) Space rows

Asparagus	Herbs	3½ ft.
Rhubarb	Nest Onions	3½ ft.
Onion from seed		3 ft.
Onion from sets		3 ft.
Early beet and radish mixed	Lettuce	3 ft.
Spring turnip		3 ft.
English pea		3 ft.
English pea		3 ft.
Irish potato		3 ft.
Irish potato		3 ft.
Irish potato		3 ft.
Early cabbage		3 ft.
Sweet corn		3 ft.
Sweet corn		3 ft.
Beet	Salsify	3 ft.
Carrot	Parsnip Parsley	3 ft.
Bush snap bean		3 ft.
Pole snap bean		3½ ft.
Bush lima bean		3½ ft.
Sweet pepper	Hot pepper Eggplant	3½ ft.
Tomato		3½ ft.
Squash	Cucumber	3½ ft.
Okra	Chard	3½ ft.

While this plan does not show spaces for celery, pole lima beans, and collards, all of these thrive when planted late in the season and may follow vegetables which mature early. It is also the practice of some gardeners to plant the pole lima beans along the garden fence so that the fence can serve as a trellis on which the bean vines may climb.

It will be observed also that no space has been provided for cantaloupes, sweet potatoes, and watermelons.



INSTALLATION OF IRRIGATION SYSTEM

(a) Shows location of pump near water supply. Metal roof on shelter protects pump and motor from rain and sun. (b) Sprinkler line attached to main line of irrigation system.



*Courtesy of Bureau of Plant Industry, Soils, and Agricultural Engineering,
United States Department of Agriculture*

IRRIGATION SYSTEM IN OPERATION

Water is pumped from dredge cut reservoir into drainage ditch (foreground) and repumped by portable pump to fields where needed.

These crops are usually planted outside the vegetable garden and much larger areas devoted to them than the vegetable garden affords. The fall turnip patch is also of sufficient importance for it to be located outside the garden where liberal space can be allowed.



*Courtesy of Bureau of Plant Industry, Soils, and Agricultural Engineering,
United States Department of Agriculture*

SEED STORAGE ROOM WITH CONTROLLED TEMPERATURE AND HUMIDITY

Seed for a Vegetable Garden 80 by 150 Feet.—

The following is a suggested list of vegetables, with varieties and quantities of seed to be purchased for a vegetable garden 80 by 150 feet in size, as already planned:

Vegetable	Variety	Amount
Asparagus.....	Mary Washington	2 oz. seed or 100 roots
Bush Snap Bean..	Stringless Green Pod, U. S. No. 5	1 qt. seed
Pole Snap Bean..	Kentucky Wonder	1 qt. seed
Bush Lima Bean..	Baby Fordhook	1 qt. seed
Pole Lima Bean..	Florida Butter	1 qt. seed
Beet.....	Detroit Dark Red	1 pkt. seed
Cabbage.....	Charleston Wakefield	1 pkt. seed or 75 plants
Carrot.....	Chantenay	1 oz. seed
Celery.....	Golden Self-Blanching	½ oz. seed
Collard.....	Georgia, cabbage- collard	1 oz. seed
Sweet Corn.....	Cherokee	½ pint seed
Sweet Corn.....	Stowell's Evergreen	½ pint seed
Corn.....	Marlboro's	1 pint seed
Cucumber.....	Long Green	½ oz. seed
Eggplant.....	N. Y. Improved	1 pkt. seed, or ½ doz. plants
Lettuce.....	Imperial 44	1 oz. seed
Okra.....	Clemson Spineless	1 oz. seed
Onion.....	Crystal Wax	1 oz. seed
Parsley.....	Moss Curled	1 pkt. seed
Parsnip.....	Hollow Crown	1 pkt. seed
Pea.....	Alaska	1 qt. seed
Pepper.....	Ruby King	1 pkt. seed
Pepper.....	Long Red Cayenne	1 pkt. seed
Potato (Irish)....	Irish Cobbler or Red Bliss	3 pecks
Radish.....	French Breakfast	1 oz.
Rhubarb.....	Victoria	1 oz. seed, or 25 plants
Spinach.....	New Zealand	1 oz. seed
Squash.....	Yellow Crookneck	1 oz. seed
Tomato.....	Penn State Earliana	1 pkt. seed
Tomato.....	Marglobe	1 pkt. seed
Tomato.....	Norton	1 pkt. seed
Turnip.....	Early Purple Top	1 oz. seed

This list of seed, as well as the plan of the garden, may be changed according to the wishes of the grower. More seed are allowed than will be found necessary to

plant the garden one time. However, experienced gardeners have learned that it is well to provide a surplus of seed in order to plant again in case the first planting is killed by frost or insects, and also to make successive plantings as the early vegetables mature and are harvested.

This garden, which is planned to be worked by hand, requires less space between the rows of plants than one to be cultivated by mule and plow. More intensive methods of planting and culture can be employed in a garden of this kind than in a large garden where horsepower is used for cultivating.

PLAN OF GARDEN 25 BY 30 FEET.

(To be worked by hand.)

	Space rows
Radish	1½ ft.
Lettuce	1½ ft.
Onion	1½ ft.
Spring turnip	1½ ft.
Beet	1½ ft.
English pea	1½ ft.
English pea	1½ ft.
Cabbage	1½ ft.
Bush snap bean	2 ft.
Bush snap bean	2 ft.
Bush lima bean	2 ft.
Bush lima bean	2 ft.
Tomato	2 ft.
Sweet pepper	Eggplant 2 ft.

Seed may be planted between the rows of vegetables just before the crop is harvested. In this way the young plants will be ready to occupy the space as soon as the crop from the first planting comes off. Where horse culture is depended upon, such interplanting cannot be

employed, for horse culture requires a minimum of two feet between the rows for satisfactory work.

Seed for a Vegetable Garden 25 by 30 Feet.—

The following are the amounts of seed and varieties of the different vegetable crops suggested for a garden 25 by 30 feet to be worked by hand. The plan has been given above:

Vegetable	Variety	Amount
Bush Bean.....	Stringless Green Pod	1 pint seed
Lima Bean.....	Baby Fordhook	1 pint seed
Beet.....	Detroit Dark Red	1 ounce seed
Cabbage.....	Charleston Wakefield	1 pkt. seed or 18 plants
Eggplant.....	N. Y. Improved	1 pkt. seed or 6 plants
Lettuce.....	Imperial 44	$\frac{1}{4}$ ounce seed
Onion.....	Silver Skin	$1\frac{1}{2}$ pints sets
Garden Pea.....	Alaska	$\frac{1}{2}$ pint seed
Pepper.....	Ruby King	1 pkt. seed
Radish.....	French Breakfast	$\frac{1}{2}$ ounce seed
Tomato.....	Marglobe	$\frac{1}{4}$ ounce seed
Spring Turnip.....	Early Purple Top	1 pkt. seed or 18 plants

It is well to add to this list one pint of snap bean seed, one packet each of carrots, parsnips, salsify, lettuce, spinach, cabbage, and one ounce of turnip seed for successive plantings. For example, a second crop of lettuce may follow the radishes; snap beans may follow the first planting of lettuce; and the summer cabbage may follow the spring onions. The turnip seed may be sown between the rows of beans, peppers, and tomatoes in September, so that when the frost kills these crops the turnips will occupy the land. The spinach, carrots, parsnips, salsify, and lettuce may be sown in any vacant rows where vegetables are harvested in August or early September. These crops are hardy and will not be injured by considerable frost.

Planting Table for Vegetables.—After the garden has been planned and the seed procured, the time and

methods of planting the seed should be studied. The following planting table gives some condensed information that will be helpful:

PLANTING TABLE *

NAME OF VEGE- TABLE	Seed or Plants 100 feet of row	Rows apart		Plants apart in row	Time to plant in hotbed	Time to plant in open soil	Parts eaten	Depth to plant seed in inches	Ready for use after planting
		For horse culture	For hand culture						
Asparagus...	75 plants	4 ft.	3 ft.	18 in.		Dec.	y'ng shoots	3	1 year
Bean—bush...	1 pt.	3 ft.	2 ft.	1 in.		Apr.	Pods	2	40 to 60 days
Bean—pole...	1½ pts.	4 ft.	3 ft.	1½ in.		Apr.	Pods	2	50 to 75 days
Bean—Lima...	1 pt.	3 ft.	2 ft.	1½ in.		Apr.	Pods	2	55 to 80 days
Beet...	2 oz.	3 ft.	18 in.	3 in.		Feb.	roots	1	60 to 75 days
Brussels									
Sprout...	¼ oz.	3 ft.	2½ ft.	2 ft.	Feb.	Mar.	heads	½	90 to 110 days
Cabbage—early...	¼ oz.	3 ft.	2½ ft.	18 in.	Jan.	Feb.	heads	½	90 to 110 days
Cabbage—late...	¼ oz.	3 ft.	3 ft.	2 ft.		Apr.	heads	½	90 to 110 days
Carrot...	1 oz.	3 ft.	18 in.	2 in.		Feb.	roots	½	75 to 100 days
Cauliflower...	¼ oz.	3 ft.	2½ ft.	2 ft.	Feb.	Mar.	bloom-head	½	95 to 120 days
Celery...	¼ oz.	4 ft.	2½ ft.	6 in.		July	l'f stalk	½	120 to 150 days
Collard...	¼ oz.	3½ ft.	2½ ft.	2½ ft.		June	leaves	½	125 to 160 days
Corn—sweet...	¼ pt.	3 ft.	3 ft.	1 ft.		Mar.	grain	1	70 to 95 days
Cucumber...	½ oz.	3½ ft.	3 ft.	3 ft.		Apr.	fruit	1	65 to 80 days
Eggplant...	1 pkt.	3 ft.	2½ ft.	2 ft.	Mar.	May	fruit	½	100 to 125 days
Kale...	¼ oz.	3 ft.	2 ft.	6 in.		Feb.	leaves	½	90 to 120 days
Kohl-Rabi...	¼ oz.	3 ft.	18 in.	18 in.	Feb.	Mar.	enl'gd st'm	½	60 to 80 days
Lettuce...	½ oz.	3 ft.	18 in.	6 in.	Oct.	Feb.	leaves	½	50 to 85 days
Okra...	1 oz.	3½ ft.	3 ft.	2 ft.		Apr.	Pods	1	90 to 125 days
Onion—seed...	1 oz.	3 ft.	15 in.	2 in.		Feb.	bulb	¾	140 to 160 days
Onion—sets...	1 qt.	3 ft.	15 in.	2½ in.		Nov.	bulb	¾	90 to 110 days
Parsley...	¼ oz.	3 ft.	18 in.	6 in.		Feb.	leaves	½	85 to 185 days
Parsnip...	½ oz.	3 ft.	18 in.	2 in.		Feb.	roots	½	120 to 160 days
Pea—garden...	½ pt.	3 ft.	2 ft.	1 in.		Feb.	Pods	2	50 to 75 days
Pepper...	1 pkt.	3 ft.	2 ft.	18 in.	Mar.	Apr.	Pods	2	95 to 130 days
Potato—Irish...	½ pk.	3 ft.	2½ ft.	1 ft.		Apr.	tubers	4	95 to 140 days
Radish...	1 oz.	3 ft.	14 in.	1 in.		Feb.	roots	½	25 to 40 days
Rhubarb...	33 plants	4 ft.	3 ft.	3 ft.		Dec.	stalks	3	1 year
Salsify...	1 oz.	3 ft.	18 in.	1 in.		Feb.	roots	½	110 to 125 days
Spinach...	1 oz.	3 ft.	18 in.	4 in.		Feb.	leaves	½	60 to 100 days
Squash...	½ oz.	3½ ft.	3 ft.	2½ ft.		Apr.	fruit	1	65 to 80 days
Tomato...	½ oz.	3½ ft.	2½ ft.	2 ft.	Feb.	Apr.	fruit	½	90 to 120 days
Turnip...	½ oz.	3 ft.	18 in.	2 in.		Feb.	roots	½	85 to 160 days
Turnip—Rutabaga...	1 oz.	3 ft.	2 ft.	3 in.		July	roots	½	75 to 100 days

* From Bulletin 96, Georgia Experiment Station.

The dates for plantings given here are for the climatic conditions of middle Georgia. Dates for plantings for the entire South are given elsewhere in this Chapter.

Compost for Seed and Plant Beds.—Well decomposed compost is very useful in starting plants in seed boxes and plant beds. A compost pile should be made and allowed to decay from 6 to 12 months before it is used. During this time it should be turned occasionally so as to aid in decomposition. Turning also improves its texture.

How to Make Compost.—Compost is made by putting down a layer of tree leaves about 12 inches thick. On top of this is placed a layer of loamy soil or sand about six inches thick. Next, a layer of stable manure about six inches thick is put on. This is followed by 6 inches more of soil or sand, 12 inches of leaves, 6 inches of soil or sand, and then stable manure again. The process is continued until the grower has enough compost made to use in his seed boxes, hotbeds, and other plant beds for at least a year. Screened coal ashes and wood ashes may be thrown onto the compost pile but care should be taken that decaying plants from the garden are not used in compost as they are likely to introduce diseases into the plant beds. The compost pile should be located in the rear of the premises where it will be out of the way.

Starting Plants Under Cover Before Spring Opens.—Much time can be saved and many young garden plants made to mature much earlier if the plants are started in seed boxes or hotbeds from six to eight weeks before it becomes warm enough to set them safely in the open garden. Plants which lend themselves best to this practice are tomatoes, peppers, eggplants, cab-

bage, cauliflowers, and lettuce. Cantaloupes, cucumbers, squashes, and even snap beans are sometimes started in small boxes or pots in hotbeds and transplanted to the garden by transferring carefully all of the soil from the boxes or pots without materially disturbing the roots of these plants.

The Window Box for Starting Plants Early.—

Where only a few plants are to be started early a box placed inside of the house by a sunny window will serve the purpose. A box 14 inches wide, 3 inches deep, and 24 inches long is a very convenient size. However, it may be well to make the box fit into the window. This box should be filled with compost soil which has been run through a sand screen. The soil should be leveled on top and then laid off into trenches about two inches apart. The seed should be sown in these trenches, covered about one-fourth of an inch deep and the soil lightly watered. The soil should be watered from time to time, though not enough water should be applied to cause it to drip from the bottom of the box. A piece of glass laid over the box before the plants come up will help to conserve the moisture.

When the plants are about two inches high they should be thinned out and transplanted to other window boxes.

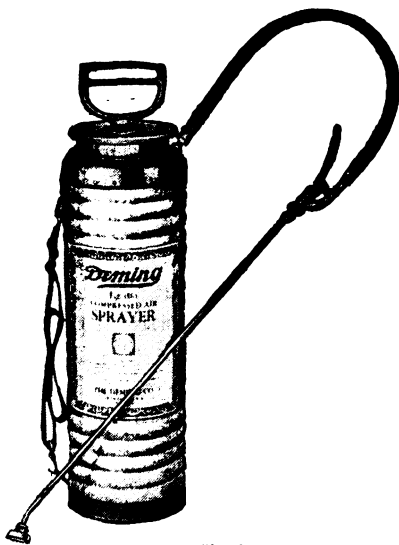
The boxes should be set outdoors during good weather in order to harden off the plants so that they can withstand transplanting to the open without a severe setback.

Starting Plants in Hotbeds.—Every gardener should have a hotbed in which to start plants for spring setting as well as for growing such crops as radishes and lettuce for family use during the winter. A hotbed 6 feet wide and 12 feet long is a very convenient size for the small gardener. He can plant a crop of lettuce or radishes in the late fall and mature it in time to clean

out the bed and put in fresh stable manure, ready for starting plants in the early spring.

The same methods given for the construction, management, and starting plants in hotbeds under tomato culture may be followed in constructing and preparing hotbeds for the home vegetable garden.

Buying Plants from Commercial Growers.—



Courtesy of The Deming Company
COMPRESS AIR SPRAYER

Some gardeners prefer buying the early plants from commercial growers rather than attempting to grow them in seed boxes or hotbeds at home. Some of the commercial growers start their plants in greenhouses, while others maintain plant beds sufficiently far South to have the plants large enough to be shipped and transplanted when spring opens in districts farther North.

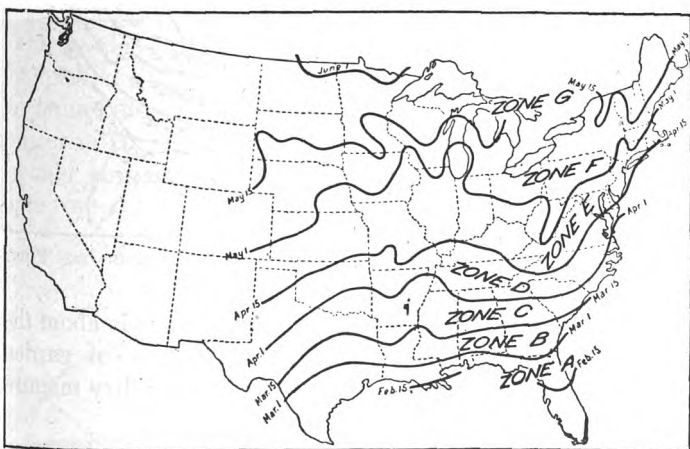
Some of the more hardy plants, as cabbage, are started in the open air in the late fall, held in the fields during the winter and sold to gardeners early the following spring as "frost-proof" plants.

Job 3—Fertilizing and Preparing the Land

The home vegetable garden, when once established, contains some growing vegetables at all times during the

year. For this reason it often becomes necessary to prepare and plant only a section of the garden at a time, even though it is feasible to fertilize the entire garden at once. The fertilizers for those sections not to be plowed may be strewn along between the rows of plants and allowed to remain there until the soil is worked.

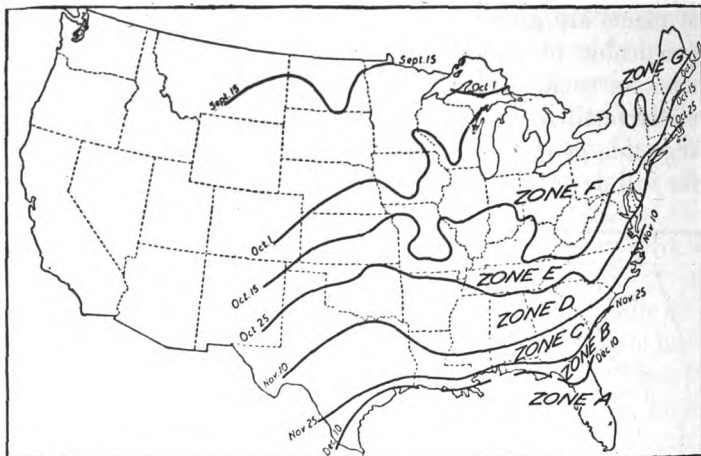
Fertilizing the Garden.—So many different kinds of plants are grown in a vegetable garden that it is not practicable to make and apply special fertilizer mixtures for each. It is better to apply liberal quantities of all the fertilizer elements deficient in the soil so that each vegetable grown will have enough available plant food for full development.



MAP SHOWING ZONES BASED ON THE AVERAGE DATE OF THE LAST KILLING FROST IN SPRING

Animal Manures for the Vegetable Garden.—Animal manures of every kind found about the barn or in stock pens are good for improving the garden soil. In fact, it is very difficult to maintain the fertility of the

garden soil without a liberal supply of animal manures or some other humus forming organic matter. Manures from horse stables, including well trampled bedding, from dairy barns, and from poultry houses are usually the most convenient supplies for the vegetable garden and all of them are excellent for this purpose. From seven to eight two-horse wagon-loads, or seven or eight



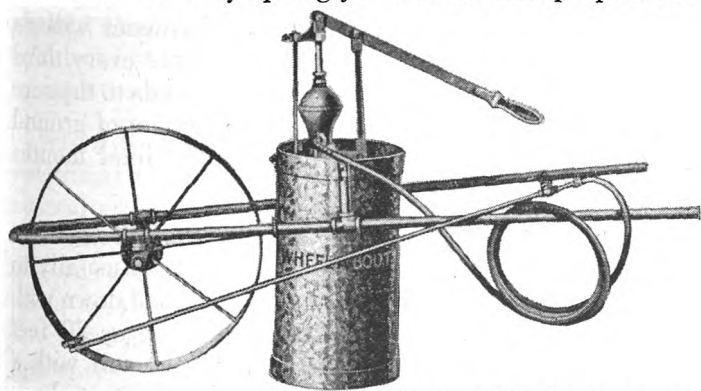
MAP SHOWING ZONES BASED ON THE AVERAGE DATE OF THE FIRST KILLING FROST IN AUTUMN

tons of ordinary barnyard or stable manure is about the correct amount to apply to one-fourth acre of garden soil. About one-sixth of this amount of poultry manure would be satisfactory for the same area.

Commercial Fertilizers for the Vegetable Garden.—Commercial fertilizers should be used to supplement animal manures. In cases where the animal manures are not available it may become necessary to use the commercial fertilizers alone. Where the grower desires to avoid the trouble of mixing small quantities of fertilizers at home, he will find it very convenient to

buy a sack or two of ready-mixed fertilizers for this purpose. A mixture containing 4 percent nitrogen, 10 percent phosphoric acid, and 4 percent of potash, applied at the rate of a ton to the acre, is none too much for a vegetable garden. It is well, also, to have some nitrate of soda on hand to put on as a side application during the growing season to hasten the growth of such leafy plants as lettuce, cabbage, mustard, turnips, etc. If the grower desires to mix his own fertilizer he could use 200 pounds of acid phosphate, 200 pounds of cottonseed meal, and 25 pounds of muriate of potash to good advantage. For very light, porous sandy soils it will be well to increase the muriate of potash in this mixture to 30 or 40 pounds.

When and How to Fertilize the Garden.—A vegetable garden which is cropped all the year round should be fertilized twice each year. Stable manure, at the rate of from 25 to 35 tons to the acre, and a commercial fertilizer mixture, at the rate of 1,000 pounds to the acre, should be applied broadcast and plowed under in the late winter or early spring just before land preparation



Courtesy of The Deming Company

WHEEL-A-BOUT SPRAYER

Seed for a Vegetable Garden 80 by 150 Feet.—
The following is a suggested list of vegetables, with varieties and quantities of seed to be purchased for a vegetable garden 80 by 150 feet in size, as already planned:

Vegetable	Variety	Amount
Asparagus.....	Mary Washington	2 oz. seed or 100 roots
Bush Snap Bean..	Stringless Green Pod, U. S. No. 5	1 qt. seed
Pole Snap Bean..	Kentucky Wonder	1 qt. seed
Bush Lima Bean..	Baby Fordhook	1 qt. seed
Pole Lima Bean..	Florida Butter	1 qt. seed
Beet.....	Detroit Dark Red	1 pkt. seed
Cabbage.....	Charleston Wakefield	1 pkt. seed or 75 plants
Carrot.....	Chantenay	1 oz. seed
Celery.....	Golden Self-Blanching	½ oz. seed
Collard.....	Georgia, cabbage- collard	1 oz. seed
Sweet Corn.....	Cherokee	½ pint seed
Sweet Corn.....	Stowell's Evergreen	½ pint seed
Corn.....	Marlboro's	1 pint seed
Cucumber.....	Long Green	½ oz. seed
Eggplant.....	N. Y. Improved	1 pkt. seed, or ½ doz. plants
Lettuce.....	Imperial 44	1 oz. seed
Okra.....	Clemson Spineless	1 oz. seed
Onion.....	Crystal Wax	1 oz. seed
Parsley.....	Moss Curled	1 pkt. seed
Parsnip.....	Hollow Crown	1 pkt. seed
Pea.....	Alaska	1 qt. seed
Pepper.....	Ruby King	1 pkt. seed
Pepper.....	Long Red Cayenne	1 pkt. seed
Potato (Irish)....	Irish Cobbler or Red Bliss	3 pecks
Radish.....	French Breakfast	1 oz.
Rhubarb.....	Victoria	1 oz. seed, or 25 plants
Spinach.....	New Zealand	1 oz. seed
Squash.....	Yellow Crookneck	1 oz. seed
Tomato.....	Penn State Earliana	1 pkt. seed
Tomato.....	Marglobe	1 pkt. seed
Tomato.....	Norton	1 pkt. seed
Turnip.....	Early Purple Top	1 oz. seed

This list of seed, as well as the plan of the garden, may be changed according to the wishes of the grower. More seed are allowed than will be found necessary to

plant the garden one time. However, experienced gardeners have learned that it is well to provide a surplus of seed in order to plant again in case the first planting is killed by frost or insects, and also to make successive plantings as the early vegetables mature and are harvested.

This garden, which is planned to be worked by hand, requires less space between the rows of plants than one to be cultivated by mule and plow. More intensive methods of planting and culture can be employed in a garden of this kind than in a large garden where horsepower is used for cultivating.

PLAN OF GARDEN 25 BY 30 FEET.

(To be worked by hand.)

	Space rows
Radish	1½ ft.
Lettuce	1½ ft.
Onion	1½ ft.
Spring turnip	1½ ft.
Beet	1½ ft.
English pea	1½ ft.
English pea	1½ ft.
Cabbage	1½ ft.
Bush snap bean	2 ft.
Bush snap bean	2 ft.
Bush lima bean	2 ft.
Bush lima bean	2 ft.
Tomato	2 ft.
Sweet pepper	Eggplant 2 ft.

Seed may be planted between the rows of vegetables just before the crop is harvested. In this way the young plants will be ready to occupy the space as soon as the crop from the first planting comes off. Where horse culture is depended upon, such interplanting cannot be

for the spring planting begins. The garden should be fertilized again during the month of August or just before planting for a fall crop of vegetables. At this time only the commercial fertilizer mixture may be applied. This should be applied at the rate of 1,000 pounds to the acre. There is no objection, of course, to the application of more stable manure or animal manures of any kind at this time. However, one application of these each year will keep the soil in a productive condition.

In addition to the above fertilizer treatment, the gardener should keep on hand a small bag of nitrate of soda or some other quickly available nitrogenous fertilizer to use around plants which show the need of more plant food during the growing season. A light application of such a fertilizer, at the rate of 150 pounds to the acre or one pound to each 100 feet of row, will be found helpful around cabbage or lettuce plants just before they begin to head or around any other vegetable plant whose growth the gardener desires to hasten.

Liming Garden Soils.—Some of the garden crops are not benefited by the use of lime on the soil. However, a number of them are and the gardener will do well to give his soil an application of lime every third or fourth year. From 1,000 to 2,000 pounds to the acre of air-slaked lime, or about twice this amount of ground limestone, applied broadcast during the winter months should prove satisfactory.

Preparing the Land.—Garden areas too small to be prepared with horse and plow are spaded usually to the depth of eight or ten inches and smoothed down with a steel tooth rake. If the area is as much as 20 feet square it would be advisable to break the soil with a horse and plow; but after it is broken it is better to keep the horse and plow out.

If the garden area to be broken is large enough for a two-horse plow to be used, it is preferable to break the soil with a double team rather than a single horse and plow, for in this way the soil can be broken much deeper and a larger amount of stable manure and other organic matter turned effectively into the soil. The soil should be harrowed a number of times to pulverize it.

Precautions should be taken not to plow the soil while it is wet. Sandy soils are not injured so seriously by being plowed while wet; but clay soils, if plowed while too wet, will be like sun-dried brick when dried and will be very difficult to cultivate.

Soil thoroughly broken and well harrowed into a smooth condition needs little other preparation for sowing garden seed; for the majority of our southern gardeners now plant their garden seed on a level rather than upon very high ridges as was once the practice. Of course very small-seeded crops and crops which are planted early in the spring are planted on beds. In such cases small or delicate plants can be cultivated better for the first time or two if they are on beds or ridges raised slightly above the general level of the soil; these beds or ridges of soil dry out and become warm earlier in the spring than soil left flat.

When to Plant Garden Vegetables in the Open.

—Ordinarily, garden plants may be divided into two general groups—"the cool season" and "the warm season" crops. Even the inexperienced gardener knows that it is useless to attempt to grow any of the tender or warm season plants when there is the slightest frost. The same gardener, however, does not realize that it is just as useless to attempt to grow some of the cool season plants during hot weather. The following plants are classed as cool season crops and may be planted in the

spring a few weeks before the danger of frost has passed: beets, cabbage, carrots, collards, lettuce, onions, parsley, parsnips, peas, radishes, spinach, and turnips. Irish potatoes, though less hardy, are planted along with a number of these because it takes the tubers a long time to germinate, and if the tops are slightly nipped by frost the plants may be expected to recover sufficiently to make a good crop.

The tender, or warm season plants, listed below, will stand practically no frost and thrive well only when the soil and air are warm: snap beans, lima beans, sweet corn, cucumbers, eggplants, peppers, okra, and tomatoes. Of these, corn will germinate and grow under cooler conditions than the others.

Dates of Planting.—The dates for planting garden vegetables in any region are governed largely by the dates of the last killing frost in the spring and first killing frost in the fall. The maps on pages 573 and 574 show such dates for the different climatic zones. The planting dates given in the following tables are based upon the frost dates of the different zones.

LATEST SAFE DATES FOR PLANTING VEGETABLES FOR THE FALL GARDEN IN THE ZONES OF THE UNITED STATES

Crop	Zone B	Zone C	Zone D	Zone E
Bean, snap.	Oct. 1-15	Sept. 15-30	Aug. 15-30	Aug. 1-30
Beet.	Oct. 1-15	Sept. 15-30	Aug. 1-30	July 15-Aug. 15
Cabbage.		Sept. 1-15	Aug. 15-Sept. 1	July 15-Aug. 15
Carrot.		Sept. 1-15	Aug. 15-Sept. 1	July 15-Aug. 15
Cauliflower.		Sept. 1-15	Aug. 1-Sept. 1	July 1-Aug. 1
Celery.		Oct. 1-15	Sept. 1-30	July 1-Aug. 1
Corn, sweet.		Aug. 15-30	Aug. 1-15	July 15-Aug. 15
Cucumber.		Aug. 15-30	Aug. 1-15	
Kale.		Oct. 15-Nov. 15	Oct. 1-30	Sept. 1-30
Lettuce.		Oct. 15-Nov. 15	Oct. 1-15	Sept. 1-30
Mustard.		Oct. 15-Nov. 15	Oct. 1-15	Sept. 1-30
Parsley.		Oct. 15-Nov. 15	Oct. 1-15	Sept. 1-30
Pea.		Oct. 15-Nov. 15	Oct. 1-15	Aug. 15-Sept. 15
Potato: Irish.		Aug. 15-30	Aug. 1-15	July 1-30
sweet.	Aug. 15	Aug. 1-15	July 15-30	June 1-30
Radish.		Oct. 15-30	Oct. 1-15	Aug. 15-Sept. 30
Spinach.		Oct. 15-30	Oct. 1-15	Aug. 15-Sept. 30
Tomato.		Aug. 15-30	July 15-Aug. 15	July 1-30
Turnip.		Oct. 15-30	Oct. 1-15	Aug. 15-Sept. 30

EARLIEST SAFE DATES FOR PLANTING IN THE OPEN IN THE ZONES OF THE UNITED STATES

Crop	Zone A	Zone B	Zone C	Zone D	Zone E
Asparagus	(Not grown)	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15	Apr. 15-May 1
Artichoke	Mar. 1-15	Mar. 15-Apr. 1	Apr. 1-15	Apr. 15-May 1	May 1-30
Jerusalem	Feb. 1-15	Feb. 15-Apr. 1	Mar. 1-15	Mar. 15-Apr. 1	Apr. 1-15
Bean: Lima	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-30	Apr. 1-15	May 1-15
Snap	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15	Apr. 15-May 1
Beet	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15	Apr. 15-May 1
Brussels sprout	Jan. 1-Feb. 1	Jan. 15-Feb. 15	Feb. 15-Mar. 1	Mar. 1-15	Apr. 15-May 1
Cabbage	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15	Apr. 15-May 1
Carrot	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15	Apr. 15-May 1
Cauliflower	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15	Apr. 15-May 1
Celery	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15	Apr. 15-May 1
Chard	Feb. 1-15	Feb. 15-Mar. 1	Feb. 15-Mar. 1	Mar. 1-15	Apr. 15-May 1
Collard	Jan. 1-Feb. 1	Mar. 1-15	Mar. 15-Apr. 1	Apr. 1-May 1	Apr. 15-May 15
Corn, sweet	Feb. 15-Mar. 1	Mar. 1-15	Apr. 1-15	Apr. 15-May 1	May 1-June 1
Cucumber	Mar. 1-15	Mar. 15-Apr. 1	Apr. 1-15	Apr. 15-May 1	May 1-June 1
Eggplant	Mar. 1-15	Mar. 15-Apr. 1	Apr. 1-15	Apr. 15-May 1	May 1-June 1
Fat	Jan. 1-Feb. 1	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15
Kale	Jan. 1-Feb. 1	Feb. 1-15	Mar. 1-15	Mar. 15-Apr. 1	Apr. 1-May 1
Kohl-rabi	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15	Apr. 1-May 1
Lettuce: head	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15	Apr. 1-May 1
leaf	Jan. 1-Feb. 1	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15
Melon	Feb. 1-15	Mar. 15-Apr. 1	Apr. 1-15	Apr. 15-May 1	May 1-June 1
Mustard	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 1	Apr. 1-May 1
Okra or gumbo	Feb. 15-Mar. 1	Mar. 15-Apr. 1	Mar. 15-30	Apr. 15-May 1	May 1-15
Onion: seed	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 1	Apr. 1-May 1
sets	Jan. 1-Feb. 1	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15
Parsley	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 1	Apr. 1-May 1
Peas: smooth	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 1	Apr. 1-May 1
Pea: wrinkled	Jan. 1-Feb. 1	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15
Pepper	Feb. 1-15	Mar. 15-Apr. 1	Apr. 1-15	Apr. 15-May 1	May 1-June 1
Potato: Irish	Jan. 1-Feb. 1	Mar. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15
sweet	Jan. 1-Feb. 1	Mar. 15-Apr. 1	Apr. 1-15	Apr. 15-May 1	May 1-June 1
Pumpkin	Mar. 1-15	Mar. 15-Apr. 1	Apr. 1-15	Apr. 15-May 1	May 1-June 1
Radish	Jan. 1-Feb. 1	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15
Rhubarb	(Not grown)	(Not grown)	Feb. 15-Mar. 1	Mar. 15-Apr. 15	Apr. 15-May 1
Salsify	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15	Apr. 15-May 1
Spinach	Feb. 1-15	Mar. 15-Apr. 1	Apr. 1-15	Apr. 15-May 1	May 1-June 1
Squash	Mar. 1-15	Mar. 15-Apr. 1	Apr. 1-15	Apr. 15-May 1	May 1-June 1
Tomato	Jan. 1-Feb. 1	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15
Turnip	Jan. 1-Feb. 1	Feb. 1-15	Feb. 15-Mar. 1	Mar. 1-15	Mar. 15-Apr. 15

Job 4—Cultivating the Garden

Cultivation should begin as soon as the plants come up from seed. Plants which are transplanted to the garden should be cultivated as soon as the roots are well established in the soil. This occurs from five to ten days after they are set out. The soil around very small tender plants should be cultivated or stirred first with a steel rake or a hand plow. As the plants become larger they may be cultivated with a mule and plow where the garden is large enough to permit their use.

Cultivations, whether by hand or by horsepower, should be frequent and shallow so as to prevent the land from forming a crust on top and to keep down weeds and grass. It is especially important to cultivate as early after each rain as the soil becomes dry enough to be stirred. Sandy soils may be cultivated while fairly wet, but clay soils require more time.

Irrigation.—The vegetable garden can be made far more productive if some arrangement can be made for irrigation during periods of dry weather. Some growers irrigate by running the water along furrows between the rows of plants. Others use underground tiling through which the water is passed, while still others use overhead pipes equipped with small nozzles through which the water spurts in fine streams and falls like rain.

Any of these methods of irrigation may be expected to increase greatly the yield of garden crops. The grower should use the method which suits his purposes best.

Job 5—Combating Insects and Diseases

The control of insects and diseases in the vegetable garden is an important job. Steps should be taken early

in the season to provide suitable outfits and materials and have them in readiness when needed.

The same spray outfit used for spraying the home orchard, which is usually a barrel spray pump, may be used for spraying the vegetable garden. If there is no orchard to spray the gardener may use a small air pressure sprayer or knapsack pump holding from three to five gallons of spray solution.

Another outfit which is well suited for spraying the vegetables and may be used also for spraying a limited number of fruit trees, is the wheel-a-bout sprayer.

What Spray Materials to Buy.—Spraying is a form of insurance for plants and the gardener cannot foretell the exact amount of spray materials he will need. However, he should provide an adequate supply, as most of the spray materials are staple products and may be carried over to the next season if not needed.

The three sprays most commonly needed in the vegetable garden are (1) arsenate of lead, (2) bordeaux mixture, and (3) nicotine sulphate. The following are the estimated amounts of materials the gardener will need for making sprays for spraying a vegetable garden of one-fourth of an acre one year. Amounts for smaller gardens may be estimated according to the size of the garden.

Powdered (or dry) arsenate of lead	5 lbs.
Hydrated lime	1 bag
Copper sulphate (bluestone)	12 lbs.
Nicotine sulphate	1 pt.
Flour of sulphur	8 lbs.

Spraying and dusting outfits may be obtained through hardware stores or may be ordered from the manufacturers whose advertisements are found in the leading

gardening and fruit growing magazines. Spray materials may be bought from the manufacturers whose advertisements are found in the same magazines or they may be bought from wholesale drug stores and other dealers in sprays.

Spray Mixtures for the Garden.—The following are the ingredients and the proportions most needed in spraying the garden:

Spray Mixture No. 1, Arsenate of Lead Spray

	<i>Small Amount</i>	<i>Large Amount</i>
Powdered arsenate of lead	2 oz.	1 lb.
Hydrated lime	5 oz.	4 lbs.
Water	3 gals.	50 gals.

Spray Mixture No. 2, Weak Bordeaux Mixture

	<i>Small Amount</i>	<i>Large Amount</i>
Copper sulphate (bluestone)	2 oz.	2 lbs.
Hydrated lime	3 oz.	3 lbs.
Water	3 gals.	50 gals.

Spray Mixture No. 3, Standard Bordeaux Mixture

	<i>Small Amount</i>	<i>Large Amount</i>
Copper sulphate (bluestone)	4 oz.	4 lbs.
Hydrated lime	6 oz.	6 lbs.
Water	3 gals.	50 gals.

Spray Mixture No. 4, Nicotine Sulphate

	<i>Small Amount</i>	<i>Large Amount</i>
Nicotine sulphate	2 tsp.	$\frac{3}{8}$ pt.
Soap (dissolved)	2 oz.	3 lbs.
Water	2 gals.	50 gals.

Spray Mixture No. 5, Bordeaux-Arsenate of Lead

	<i>Small Amount</i>	<i>Large Amount</i>
Weak bordeaux mixture (No. 2)	3 gals.	50 gals.
Powdered arsenate of lead	1 oz.	1½ lb.

Spray Mixture No. 6, Standard Bordeaux-Arsenate of Lead

	<i>Small Amount</i>	<i>Large Amount</i>
Standard bordeaux mixture (No. 3) . . .	3 gals.	50 gals.
Powdered arsenate of lead	2 oz.	1 lb.

Spray Mixture No. 7, Bordeaux-Nicotine Sulphate

	<i>Small Amount</i>	<i>Large Amount</i>
Bordeaux mixture (No. 3)	3 gals.	50 gals.
Nicotine sulphate	3 tsp.	¾ pt.
Soap (dissolved)	2 oz.	3 lbs.

Spray Mixture No. 8, Combined Spray

	<i>Small Amount</i>	<i>Large Amount</i>
Standard bordeaux mixture (No. 3) . . .	3 gals.	50 gals.
Powdered arsenate of lead	2 oz.	1 lb.
Nicotine sulphate	3 tsp.	¾ pt.
Soap (dissolved)	2 oz.	3 lbs.

Dust Mixture No. 9, Arsenate of Lead

	<i>Small Amount</i>	<i>Large Amount</i>
Powdered arsenate of lead	2 oz.	1 lb.
Hydrated lime	1 lb.	16 lbs.

Mixture No. 10, Poisoned Bait for Cutworms and Grasshoppers

	Small Amount	Large Amount
Wheat bran	2 qts.	1 bu.
White arsenic or paris green	1 oz.	1 lb.
Cheap molasses	1 pt.	2 gals.
Lemon (grated)	1¼ lemon	6 lemons
Water to make stiff dough.		

The several spray mixtures serve as a medicine chest for the garden. All of them may not be needed during one season; however, it is well to have them on hand and use them with the first indication of an outbreak of insects or diseases.

How the Sprays Are Prepared.—Preparing the sprays is a very simple task. Directions for preparing bordeaux mixture are given in detail in Chapter XXVI.

The arsenate of lead spray is made by first mixing the lime with a small quantity of water. The arsenate of lead is made into a thin paste with water and then mixed with the lime. Water is added to make up the volume called for in the mixture.

The nicotine sulphate spray is made by first chopping the soap finely and dissolving it in hot water. It is then made up to the desired volume with water and the nicotine sulphate poured in.

Where arsenate of lead, soap, or nicotine sulphate are to be added to bordeaux mixture they are made into a thin paste or dissolved, if not already in solution, with water and stirred into the bordeaux mixture after the bordeaux mixture has been made.

The lime and arsenate of lead, for a dust mixture, are merely stirred together in the proportions indicated.

The ingredients for poisoned bait are stirred together and worked into a stiff dough with water.

The hydrated lime recommended for these mixtures is the ordinary dry lime commonly used for building purposes.

For What Purpose the Different Sprays Are Used.—The arsenate of lead mixtures are used to kill those insects which eat holes in plants and fruit, as tomato worms, cabbage worms, cutworms, etc. These are called chewing insects.

Sprays containing soap and nicotine sulphate are used to repel or kill insects. They are most effective in the control of plant lice and the red spider, which are classed as sucking insects.

Bordeaux mixture is used to coat the surface of plants and protect them against the attacks of diseases.

BRIEF CULTURAL DIRECTIONS FOR GARDEN CROPS

The following brief cultural directions for vegetable crops are supplementary to the foregoing garden plans, planting tables, and suggestions for soil management. Each of the crops may be analyzed for further study into the jobs set up in the foregoing discussion namely (1) selecting land for the crop, (2) procuring the seed or plants, (3) fertilizing and preparing the land, (4) planting and cultivating, (5) controlling insect pests and diseases, and (6) harvesting and utilizing.

ASPARAGUS

There is a strong demand for asparagus on the markets of the larger towns and cities. The gardener, who is so located that he can supply these markets, will find it profitable to produce some asparagus for sale as well as for home use.

Soils and Fertilizers for Asparagus.—Asparagus requires a very deep fertile soil which should be heavily fertilized each year. Poor soil produces small, spindling shoots and low yields of asparagus.

Varieties of Asparagus.—The Mary Washington and Palmetto are the two varieties of asparagus most commonly recommended for the South. These are both heavy yielding varieties and are resistant to asparagus rust, which is very destructive to some varieties.

Growing Asparagus from Crowns.—Where the grower desires only a small area of asparagus, he can buy well-developed, one-year crowns and plant them in late fall or during the winter.

The soil should first have a broadcast application of stable manure and a fertilizer high in nitrogen. A 10-5-5 fertilizer would serve this purpose. After the soil is deeply broken the rows are laid off about five feet apart and plowed 10 or 12 inches deep with a turn plow. The crowns are set about 20 inches apart down in the bottom of the furrow. Fresh moist soil is worked in around the roots, which should have their natural spread. When the crowns are set they should be about five or six inches below the general level of the soil.

Growing Asparagus from Seed.—If the gardener is willing to wait one additional year for his crop he can grow the crowns from seed.

Seed planted in fertile soil in the early spring will produce crowns ready to set out the following fall. Rows for sowing seed should be about three feet apart and the seed sown about an inch apart in the drill. The plants are thinned to a distance of about three inches apart after they come up. One ounce of good seed will produce about two hundred crowns. The young seed-

lings should be cultivated frequently, and should have a sidedressing of fertilizer high in nitrogen during the summer to develop strong, vigorous crowns.

Male Plants Best for Planting.—If the grower will observe closely, he can pick out the male plants from the female plants in the nursery row as soon as they bloom. The male plants produce only pollen-bearing flowers and produce no seed. These make larger and more vigorous shoots and are better yielders when planted to the garden or field. From male plants also there are no seedlings which are often troublesome as weeds in asparagus fields.

Cultivating Asparagus.—Cultivation is begun in the late winter or early spring as soon as weed growth begins.

During the first summer after the crowns are set frequent shallow cultivations are given. At each cultivation the furrow is allowed to fill up gradually as the shoots become strong enough to push through the soil. If several rows of asparagus are planted, a row of bush snap beans or English peas may be planted between the rows of asparagus the first year. Cultivation should begin each spring before the asparagus starts to grow, and should be continued until after the cutting season.

If blanched or white asparagus is desired, the rows are ridged 10 or 12 inches over the crowns early in the second year after planting. But if green asparagus, which is better, is preferred, level culture or very low ridges over the rows will be satisfactory.

Harvesting Asparagus.—No asparagus should be cut the first season after planting, and only a small amount cut the second year. If vigorous crowns are planted and grow well the first season, the shoots may

be cut during a period of from two to three weeks the second season. Asparagus is one of the first plants to start growth in the spring. Harvesting for green asparagus may begin as early as the shoots reach a height of four or five inches above the soil. For white asparagus the shoots should be cut just as they push through the soil.

After the second year, cutting is begun as soon as growth starts and may extend over a period of from six to eight weeks.

An ordinary meat knife may be used for cutting small quantities. However, a knife especially designed for the purpose can be purchased where large quantities are to be harvested.

The shoots should be cut an inch or two above the crown and care should be taken not to injure the crown and not to cut young shoots which have not appeared above the soil if it can be avoided.

Grading and Packing Asparagus.—Asparagus to be sold should be graded into three grades according to diameter. The shoots are cut from $8\frac{1}{2}$ to $9\frac{1}{2}$ inches long and tied in bunches. The bunches should be from 10 to 11 inches in diameter and tied with two bands of tape or raffia. Bunching machines are used to make the bunches uniform in size. Asparagus should be handled rapidly and gotten to the consumer as promptly as possible after it is cut. If it is to be shipped to a distant market, the crate is lined with paper and a layer of damp sphagnum moss is placed in the bottom of the crate so that it will come into contact with the cut ends of the bunches. Crates for shipping asparagus should be $19\frac{1}{2}$ inches long, $10\frac{1}{2}$ inches wide at the top, $9\frac{1}{2}$ inches wide at the bottom, and 11 inches deep. It takes from 12 to 18 bunches to make a crate of asparagus,

depending upon the size of the bunches. An acre should yield about 100 crates each year during the productive life of the crop. This is about 12 years.

BEANS

Beans constitute one of the most important groups of



Courtesy of Elmo Ragsdale

FIELD OF SNAP BEANS

plants found in the vegetable garden. They are grown more generally than any other one crop.

Soils for Beans.—Where the planting of beans is to be confined to the home vegetable garden there is very little choice of soils and fertilizers. However, where the grower desires to extend his plantings beyond the garden to produce beans for sale, a fertile, sandy loam, rich in organic matter and highly retentive of moisture should be selected.

Fertilizers for Beans.—Even though beans are leguminous plants and get a part of their nitrogen from

the air, they are benefitted greatly by liberal applications of fertilizers containing a fair amount of nitrogen. Nitrogen in the fertilizer mixture is decidedly beneficial to beans that are grown and harvested as green snap beans, for they should be grown rapidly in order to produce a tender crisp product.

Beans grown for their mature dry seed require less nitrogen in the fertilizer mixture, as the plants have more time to get it from the air. Plants grown only for fresh snap beans which produce their crop 60 or 70 days after planting, require more nitrogen.

A fertilizer mixture containing 4 percent nitrogen, 8 percent phosphoric acid, and 6 percent potash should be satisfactory for beans. From 600 to 800 pounds to the acre applied in the drills just before the beans are planted should be satisfactory.

Choosing Varieties of Beans.—The home vegetable garden should grow a number of varieties and types of beans in order to supply the family with different sorts over a long season. Commercial bean growers seldom plant more than one or possibly two varieties,



*Courtesy of Bureau of Plant Industry, Soils, and Agricultural Engineering,
United States Department of Agriculture*

HARVESTING SNAP BEANS

as they find it more profitable to handle large quantities of one kind than to attempt to build up a trade for so many varieties.

The varieties of beans commonly grown in the home vegetable garden may be divided into two general groups: (1) snap beans and (2) lima beans. Each of these may be divided into pole and bush varieties. The grower can select either white seeded or colored seeded varieties of these groups. He can find green or wax (white) podded varieties also among the snap beans.

Bush Snap Beans.—Good varieties of green-podded bush beans for the home garden and for market are Stringless Green Pod, Bountiful, Stringless Black Valentine, and U. S. No. 5. Some of the wax varieties are Rustproof Wax and Black Wax. The wax varieties are more susceptible to disease and are less in demand on the southern markets than the green-podded varieties.

Pole Snap Beans.—Pole snap beans are rarely planted in large areas for shipping, but they have an important place in the home vegetable garden and are also popular in some of the local markets. They must be given some support on which to climb and are consequently more troublesome to grow than bush snap beans. They bear over a longer season and are of better quality than the bush varieties. The two leading varieties of pole snap beans are Kentucky Wonder and Cornfield. The Cornfield bean may be found in a number of different colors.

Bush Lima Beans.—The lima beans are known as butterbeans also. These are found in both white and colored seeded sorts as well as in large and small seeded varieties.

The large seeded lima beans, both the bush and pole

varieties, since they are not well adapted to southern conditions, are not recommended generally.

Where the consumer does not object to colored seeded lima beans the Jackson Wonder Bush Lima is one of the best for the South. This is a low growing, very prolific variety, which has brown speckled seed. It is one of the most drought resisting varieties of its class. Baby Fordhook is a small seeded white bush variety that is also prolific and very desirable where a white bean is desired.

Pole Lima Beans.—Pole lima beans, like the pole snap beans, require sticking or some support on which to climb. They are heavy yielders and continue to bear over a long season.

The Florida Butterbean, which is a white and brown speckled variety, and the small White Lima, a white variety, are the two leading varieties of this group for southern plantings.

When to Plant Beans.—Beans are very sensitive to frost and should not be planted until spring opens. Lima beans are even more subject to cold than the snap beans.



COMPARATIVE YIELD OF IRRIGATED (*left*) AND NON-IRRIGATED (*right*)
SNAP BEANS FROM THE SAME SIZE PLOT

Lima beans are planted from one to two weeks after snap beans. The soil should become warm before lima beans are planted.

Beans for a Fall Crop.—It takes bush snap beans from 60 to 70 days to bear after they are planted. It takes most varieties of lima beans and pole snap beans from 80 to 100 days to produce fruit. In planting for a fall crop in any region the seed should be planted in time for the variety to produce its crop before the first frost in the fall is expected.

How to Plant Beans.—The land is first broken to the depth of from seven to ten inches, harrowed, and laid off in rows. The rows for bush beans are spaced from 30 to 36 inches apart, while for pole beans they are spaced from 3½ to 4 feet apart. The fertilizer is applied in the furrow and listed on making a broad round top ridge. Beans in the vegetable garden are usually planted by hand. A small furrow is opened on top of the ridge by means of a hand plow or a small bull-tongue plow drawn by a mule. The seed beans are dropped in this furrow from one to two inches apart. Bush snap beans are usually planted a little thicker than the lima beans or the pole snap beans. It is well to plant enough seed to produce plants about three inches apart for the bush snap beans and about five inches apart for the lima beans and the pole snap beans.

The seed should be covered, on the average, about one and a half inches deep. They may be covered a little deeper on soft mellow soils than on stiff soils. Gardeners usually allow about a pint of seed beans to plant 100 feet of row space. Where large areas are to be planted it requires from three to four pecks of the smaller seeded varieties, and from four to five pecks of the larger seeded varieties to plant an acre.

Planting Beans with Planters.—Where fields of beans are to be planted it is more satisfactory to use some type of planter. Some truck farms use seeders

pushed by hand. Most varieties of beans can be planted more rapidly by means of horse-drawn planters. The better grade of corn planters have plates which can be put in for dropping beans. Some of these planters have fertilizer attachments which enable the grower to fertilize and plant the beans at one operation.

Cultivating Beans.—Cultivation should begin as soon as the beans are up. In fact, a light cultivation before the plants come up often will help them push through the soil. Strict precautions should be taken not to injure the young plants, as they are very easily destroyed when coming up.

Frequent shallow cultivations should be continued until harvesting begins. Care should be taken not to cultivate or disturb the plants while they are wet. Cultivation at this time is likely to spread the spores of disease from one plant to the other if there are diseased plants scattered along the rows.

Sticking Pole Beans.—Both the snap and lima varieties of pole beans climb readily on any frame or trellis provided for them. Some gardeners plant such beans along the garden fence to save the trouble of sticking them. A very simple method, however, is to stick two rows together. This is done by putting up fairly stout posts about 30 feet apart between the two rows of beans to be stuck. A smooth wire is fastened to the tops of these posts from four to five feet above the ground. Canes, laths, or similar supports are placed about 12 inches apart on each of the two rows of beans and made to lean over against the wire. If these supports are long enough to extend 15 or 20 inches beyond the wire, it will give the bean vines a greater distance to climb. In addition, these extending canes will form a deep crotch

above the wire in which a light pole can be tied to hold the supports in place.

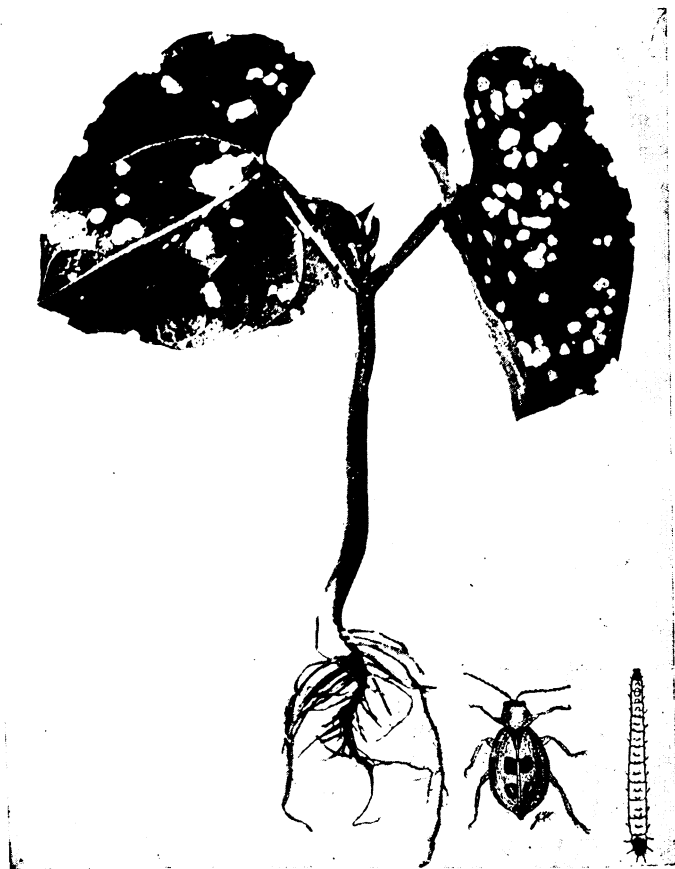
Use One Trellis for Three Varieties.—The gardener often makes one trellis support three varieties of beans. He mixes Kentucky Wonder and Cornfield beans in equal parts and plants them in one row. He then plants pole lima beans in the adjoining row. The Kentucky Wonder variety, being earlier than the Cornfield bean, covers the stakes and produces its crop which is harvested just before the Cornfield variety reaches full bearing. The Cornfield variety will cover the same trellis or stakes and continue bearing for several days after the Kentucky Wonder beans are gone. By the time the Cornfield beans quit bearing and the vines partly dry up, the lima beans from the opposite row will be ready to cover the stakes and continue bearing until frost.

Beans Planted with Corn.—The different types of Cornfield beans are well suited for planting with corn which serves the vines as a support. The beans are planted between the hills of corn after the corn has reached a height of about one foot. Very fertile moist bottom land is best suited for growing corn and beans together. The fertile moist valleys of the mountains are noted for growing beans among corn, and often afford the grower a supply of dry beans for winter use, as well as an abundant supply of snap beans for eating, canning, and drying during the summer.

Insects and Diseases of Beans.—Beans are susceptible to a few insects and diseases which demand attention.

Bean Leaf Beetle.—This small spotted beetle eats holes in the leaves soon after the plants come up. To

control spray with spray mixture No. 1 or dust with dust mixture No. 9. Use these materials sparingly while the beans are young to prevent spray burn on the foliage. Weak bordeaux spray mixture No. 2 will also repel these beetles.



A YOUNG BEAN PLANT

Showing leaves badly damaged by bean leaf beetle. Insert shows the insect.

Mexican Bean Beetle.—The Mexican bean beetle is a spotted insect somewhat smaller than the potato bug. It eats the foliage and stems of the bean plant. Apply spray mixture No. 1 or dust the plants with rotenone. Poison often enough to keep new foliage covered. Beans from poisoned vines may be eaten if washed.

Plant Lice on Beans.—Spray with spray mixture No. 4.

Bean Anthracnose.—This disease, called pod spot, can be partially controlled by spraying with bordeaux spray mixture No. 3. It is recommended that seed beans be saved only from disease-free plants. Crop rotation is also advised.

Mildew.—Pick off diseased pods and spray vines with spray mixture No. 3.

Harvesting and Marketing Beans.—Beans in the home vegetable garden are harvested only as they are needed for home consumption. Additional labor for harvesting beans is required if they are grown in commercial quantities. A field of bush snap beans is picked over about three times during the process of harvesting. A good picker should average about ten bushels for the day. An acre will produce from 100 to 150 bushels—sometimes more. Therefore, the grower should provide at least ten days of labor to harvest each acre of snap beans he plants.

Some growers use half bushel baskets while others use cotton-picking sacks for picking the beans. As the beans are picked they are carried to the shade where they are spread on tables for grading. All the oversized, tough, and undersized, as well as diseased beans, are thrown out and the others packed into bushel ham-

pers for shipping. As the beans are poured into the hampers they are shaken down and heaped on top before the lids are put on so that the packages will be full when they reach the market. Snap beans are classed as a perishable product and should be shipped by express or in refrigerator cars. Snap beans are sold through the same channels of trade as other truck crops.

BEETS

Beets will grow on almost any fertile soil. However, the roots are smoother and more attractive when grown in a light loamy soil. Beets will stand considerable cold and may be planted in the early spring while there are still light frosts.

Fertilizers for Beets.—Beets require a fertilizer high in nitrogen. A broadcast application of stable manure supplemented with commercial fertilizers is recommended. If commercial fertilizers are used alone from 1,000 to 1,500 pounds to the acre should be applied. A mixture containing 8 percent nitrogen, 8 percent phosphoric acid, and 8 percent potash should be satisfactory. In addition to this it is advisable to give a side application of nitrate of soda or some other nitrogenous fertilizer when the roots begin to expand. From 100 to 200 pounds to the acre is recommended for the side application.

What Varieties to Plant.—There are both red and yellow varieties of beets. The red varieties are in greatest demand for table use. Crosby Early Egyptian, Detroit Dark Red, and Early Wonder are popular varieties for the home gardens and for the markets. Swiss Chard is a variety of beet grown entirely for its tops. The fleshy stems are the parts eaten.

Where there is a surplus of land the Mangel Wartzel, which is a very large, productive, coarse variety may be planted and used for feeding poultry and cattle during the winter.

Planting Beets.—The soil for beets should be well broken and very finely pulverized. The rows are laid out about 30 inches apart for horse culture, or 18 inches apart for hand culture. The seed are sown in shallow drills and covered to the depth of about a half inch. One seed may be dropped to each inch of row or one ounce used to sow about 100 feet of row. It requires from five to seven pounds of beet seed to plant an acre. Beet seed do not germinate quickly. For this reason, some growers mix a few radish seed with them in planting. The radish seed germinate quickly and serve to mark the rows so cultivation can begin early.

When the beets reach a height of about two inches they may be thinned to a distance of from two to four inches apart or they may be allowed to remain without thinning and pulled out and used as they become large enough. Young beets can be transplanted to fill out any gaps in the row.

Cultivating the Crop.—Cultivation should be shallow and frequent so as to produce a rapid, tender growth of the roots. Almost any cultivator that will serve to cultivate other small garden plants will serve this purpose.

Harvesting Beets.—Where the land is soft, beets may be pulled up by hand. If the soil is stiff it may require a hoe or spading fork.

Where beets are grown on a commercial scale they are plowed up, tied in bunches, washed, and packed into cabbage crates or bushel hampers and shipped.

CABBAGE

Cabbage is easily grown, and it is one of the hardiest of our vegetable crops.

Soils and Fertilizers for Cabbage.—This crop is a gross feeder, and for large yields must have a rich soil with an abundance of moisture. Light, sandy loam soils are suitable for the production of early cabbage, but the heavy soils give larger yields.

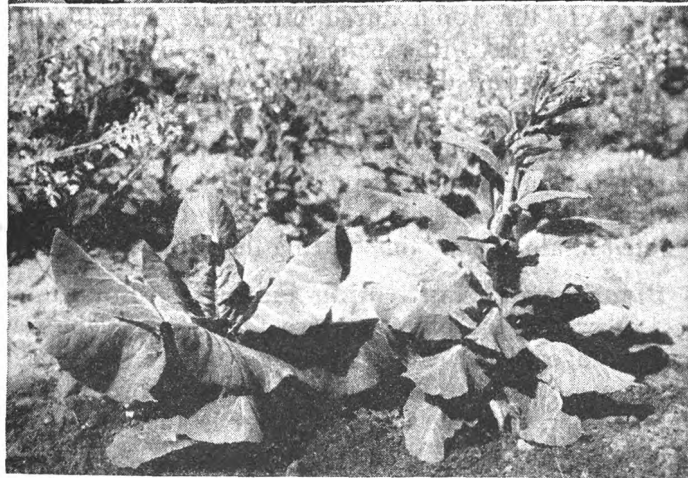
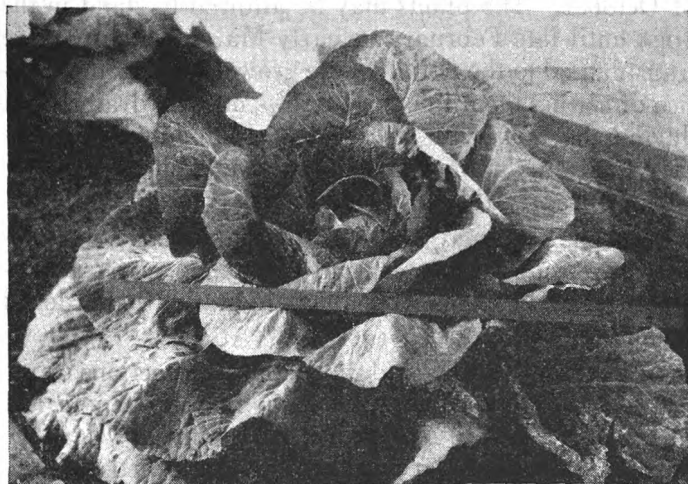
The fertilizer treatment recommended for the home vegetable garden is suitable for cabbage even when planted in large quantities. A side application of 200 pounds per acre of some nitrogenous fertilizer, as nitrate of soda, given about the time the plants begin to head, will greatly increase the yields. If a water supply is convenient, irrigation during dry weather will also greatly increase the yield.

Selecting Varieties of Cabbage.—For the production of an early crop the Jersey Wakefield for first early, and the Charleston Wakefield for second early, are two good varieties. Both have pointed heads. The Early Summer is a desirable second early variety. It is a round-headed cabbage.

Among the midseason varieties with semi-round and flat heads are All Seasons, Flat Dutch, and Succession. The North Carolina Buncombe and Danish Ball Head are good late varieties.

Growing Cabbage Plants.—The cabbage requires a cool, moist season for best development. The plants should be started at such a time that they will mature at the most favorable season in any given locality. In the lower South, where cabbage will grow during mid-winter, the seed are sown in October, the plants set to

the field in early December, and the crop harvested in late winter and early spring. In the middle South where



CABBAGE-COLLARD HYBRID (*above*)

Charleston Wakefield Cabbage (*below left*), and Collard (*below right*).

the winters are cold enough to stop active growth, the plants are sown in the open from the first to the middle of October. The plants may be allowed to stand in the open until late February or early March when they are transplanted to the field. Some growers follow the practice of setting them in open furrows on well drained soil during the month of December. Planted in this way they will remain more or less inactive during the winter and head early the following spring.

Cabbage seed may also be sown in hotbeds or in window boxes, in midwinter, and the plants given protection until early spring when they are gradually hardened off and set in the open.

In the mountainous and more elevated sections of the South, cabbage seed may be sown in the open in late spring and the crop matured in midsummer. Here the seed may also be sown in partially shaded beds in midsummer and the crop matured in the fall. Plants which head in late fall will frequently stand in the open in good condition all during the winter.

Where the home gardener wants only a few plants to produce early spring cabbage it is very convenient to purchase them from a commercial grower. These are sold as "frost-proof" cabbage plants and may be transplanted at almost any time during the winter.

Planting and Cultivating Cabbage.—Rows three feet apart and the plants set two feet apart in the row are average distances for spacing cabbage. Cabbage plants are easy to transplant and live well, even during dry weather, if about a pint of water is poured into the hole when the plant is set.

The crop should be kept free of weeds by frequent shallow cultivation. The soil should be stirred lightly soon after each rain.

Cutworms.—Cutworms breed in sod lands and in uncultivated areas near the garden or field. Poisoned bait mixture No. 10 should be strewn over the land before the plants are set out. Where there are only a few plants to protect, paper cuffs may be tied around them when they are set to the garden. In setting the plant, the stem should be planted deeply so the outer leaves will fold over the bud. This will often cause the cutworm to feed on the outer leaves and protect the bud.

Green Cabbage Worm.—The white butterfly, with a few black spots, found flying about over the garden in the spring is the parent of the green worm found on the plants. The plants may be sprayed with mixture No. 1 or dusted with mixture No. 9. An application every ten days or two weeks should give the necessary protection. Cabbage so poisoned may be consumed with safety if washed.

Harlequin Bug.—This is the common red and black spotted bug found attacking cabbage, collards, mustard, and other plants of this class. The Harlequin bug sucks the juices from the plant and cannot be poisoned with arsenate of lead or other stomach poisons. A contact spray strong enough to kill these bugs will kill the plants. About the only remedy is to pick the bugs by hand and destroy them. If they are caught immediately after they appear in the spring, it sometimes prevents a second brood.

Cabbage Maggot.—The cabbage maggot which attacks the roots of plants can often be kept out by placing a small disk of tar paper around the plant at the time it is set to the garden.

Plant Lice.—One or two applications of spray mixture No. 4 should control plant lice.

Cabbage Diseases.—Spraying is not recommended generally for cabbage diseases. The grower must use preventive measures instead.

Damping-Off Fungus.—The treatment for damping-off fungus, which attacks plants in the seed bed, consists in applying air-slaked lime and stirring the soil frequently. This disease is not severe in the field.

Black Leg and Black Rot of Cabbage.—These are two serious diseases of the cabbage. The black leg is much more common in southern gardens and fields. The black rot, produced by bacteria, causes dark spots on the leaves and stems. The black leg disease is most pronounced on the stalk just above the soil. It causes the tissue to shrivel and turn dark, often girdling the plants.

The best method of preventing these diseases is to rotate cabbage with crops that do not belong to the cabbage or brassico group of plants. In addition, the seed should be treated before they are planted. The two methods of treating seed to prevent these two diseases are as follows:

Corrosive Sublimate Treatment.—Dissolve one tablet of corrosive sublimate (mercuric chloride) in a quart of water (1 to 1,000 solution) in a wooden vessel. Place the seed in a small cheese cloth bag and dip them into the solution, working the bag around in the solution so that all the seed will be wet promptly. Soak them in this manner for 30 minutes. Then take the bag out and wash the seed with fresh water. Dry the seed at once and plant when convenient.

Hot Water Treatment.—Heat a large vessel of water to exactly 122° F. as shown by a thermometer. Then immerse the cheese cloth bag containing the cabbage seed and stir slowly to allow the hot water to come

in contact with the seed. When the water cools down below 122° F. take the bag of seed out and pour in sufficient boiling water to raise the temperature of the water in the vessel back to 122° F. The seed are then put back into the water. They are kept in the water at this temperature for 30 minutes, then removed, washed with clean cool water, and spread to dry. As old seed are sometimes injured by the hot water treatment it is best to treat a few seed first and make a germination test before treating the entire lot.

Cabbage Yellows.—About the only remedy offered for the control of this disease is the selection of resistant plants.

Harvesting Cabbage.—Cabbage for home use and for the local markets, where they are to be consumed at once, may be harvested when the heads are about half developed. These are called green cabbage. Many consumers like them at this stage of maturity. Where they are to be held for a considerable time before consumption, however, the head should become hard and firm before it is cut.

Cabbage for shipping is packed about 100 pounds to the crate. Crates for shipping cabbage where harvesting is not done promptly as the heads mature are 12 by 18 by 33 inches.

How to Prevent Bursting of Cabbage.—If the harvesting is not done promptly as the heads mature, they will split open during periods of weather favorable to active growth. If the growth of the plants is checked, bursting of the heads will be greatly retarded. This may be accomplished by going through the field and pushing over all the heads which are fully mature. They should be pushed to the north to prevent injury

from the sun. If practically all the heads are mature, the growth may be checked by running a small plow close up to the rows, cutting a large number of the lateral roots. This practice should be resorted to only when poor markets or other conditions force a delay in harvesting.

Yields and Prices of Cabbage.—Both yields and prices of cabbage are so variable that no one set of figures would apply. Yields ranging from 5 to 15 tons per acre are not uncommon, while the price may vary from two to ten cents per pound. When there is a shortage in the production of late cabbage in the North, good prices may be expected for southern cabbage the following spring.

CELERY

Celery thrives best on low moist but well-drained soils. The muck lands of the Great Lakes region and the Hammock lands of Florida are well adapted to this crop. In other sections, if the grower desires to grow celery for the market he should locate his plantings on low, fertile, sandy loam bottomlands where the crop will be well supplied with moisture. If he is equipped to irrigate the crop in dry weather, celery can be grown on almost any fertile upland soil.

For home use, practically any soil used for a vegetable garden will grow celery. If the gardener is prepared to irrigate during dry weather his chances for success are greatly increased. Celery may follow early crops of beans, onions, and Irish potatoes.

Fertilizers.—The kind and quantity of fertilizers recommended for cabbage will be found suitable for celery.

Selecting the Variety.—The Golden Self Blanching and Giant Pascal are varieties of celery commonly used, and are best adapted possibly to the South. They are strong growers and blanch easily. The White Plume is a rather small growing, early variety, but does not keep well. The Giant Pascal is a large, late variety.

Growing the Plants.—Celery is usually grown in the South as a fall or winter crop. In the lower South, the plants are set to the field in late fall and the crop harvested early the following spring. In the middle and upper South the seed are sown in early summer, the plants being set to the field in late July or early August. The crop thus planted will be ready for use by Thanksgiving Day or before.

Celery seed should be sown in semi-shaded beds of fertile soil, near a water supply so that the plants can be watered during dry weather. Some growers shade the beds with slatted frames, while others locate the beds near trees so situated as to give shade during the heat of the day. Eight ounces of seed sown in 250 square feet of bed space should produce enough plants to set an acre.

Transplanting.—When the plants are about two inches high they should be transplanted to other beds. They should be set about three inches apart each way to permit the formation of a good root system. Where only a few plants are to be handled they can be transplanted to small pots and held for two or three weeks, enabling the grower to set them to the garden with very little loss.

Seed sown in plant beds in late May will produce plants ready to set in July. However, they may be held until early August if necessary.

Preparing the Soil and Setting the Plants.—

Land maturing early crops of vegetables should be well broken and harrowed in June. The fertilizers should be applied broadcast before the land is broken. If the celery is to be blanched by raking up soil against the plants, the rows should be about five feet apart; but if boards or paper are to be used, three and a half feet apart will be sufficient. The plants should be set in very shallow furrows 10 or 12 inches deep, on well drained uplands.

The plants are set about eight inches apart in the furrow. They should be well watered as they are put out unless the ground is wet.

Cultivating and Spraying the Celery.—The plants are given regular clean culture until the weather begins to turn cool. At this time blanching begins.

Celery blight or leaf spot causes a great deal of damage some seasons. The plants should be sprayed once or twice with 4-5-50 bordeaux mixture in the seedbed. The spraying with the same mixture should be repeated every ten days or two weeks after the plants are set to the field until blanching begins.

Blanching Celery.—Celery is blanched by excluding the light from the leaf stalks which are the edible parts. One method of blanching is to rake soil up against the plants, taking care not to cover up the beds. Boards or dark colored paper may be used for the same purpose. However, paper containing tar or creosote in its fibre should not be used as this gives the celery an undesirable flavor.

Harvesting Celery.—Celery for home use may be harvested as desired. A crop that is to be sold should be harvested as soon as blanched in order to avoid loss

in the field by decay or disease. In harvesting, the blanching material is removed and the roots cut about two inches below the base of the leaf stalks.

Celery to be sold is usually crated in the field without being washed. Slatted crates 10 by 20 by $22\frac{3}{8}$ inches in size are commonly used for this purpose. The slats are placed several inches apart on the sides to allow ventilation.

CARROTS

The soil preparation, fertilizers, and culture for carrots are practically the same as for beets.

Carrots are eaten more generally in winter than in summer. They are especially rich in vitamins.

The seed may be sown in the early spring at the same time that beets and radishes are sown. Any carrots not consumed during the summer may be allowed to remain in the soil for winter use. Seed sown in July and August make smoother roots for fall and winter use.

COLLARDS

The collard is one of the highly prized plants for winter greens in most southern gardens. This plant is essentially a leafy cabbage and the cultural requirements of the two crops are the same.

The common practice is to sow collard seed in the open in late May or early June. The plants are set to the field or garden in July or August. The crop will mature in time for late fall and winter use. Planted at this time of the summer the plants escape the attacks of early broods of the Harlequin bug and the green cabbage worm. Collards may follow the early maturing vegetable crops.

Harvesting and Marketing.—The collard is very resistant to cold and may be left in the open and harvested as needed in late fall and winter.

Collards are in considerable demand in the manufacturing centers of the South, and growers find the crop profitable where daily deliveries can be made. The



*Courtesy of Bureau of Plant Industry, Soils, and Agricultural Engineering,
United States Department of Agriculture*

CORN EARWORM EATING WAY INTO SIDE OF EAR

crop is not suited for shipping to distant markets as it wilts soon after harvesting.

The control of insects and diseases of collards is the same as for cabbage.

CORN

Sweet corn for the early crop should be planted just as early as practicable for the plants to escape the last spring frosts. The rows should be about 3 feet apart and the grains dropped from 12 to 18 inches apart in the row. The richer the soil the thicker the corn can be planted.

Sweet corn does not make heavy yields. For this reason most gardeners plant a few rows of a prolific white variety of field corn at the same time the sweet corn is planted. The field corn will be ready for use soon after the sweet corn passes out. Where a continuous supply of roasting ears is desired, successive plantings should be made about every two weeks.

Cherokee, Stowell's Evergreen, and Country Gentleman are good varieties of sweet corn, while Marlboro or almost any of the prolific white varieties of field corn will serve for the main crop.

Corn should be planted in a different place in the garden each year to lessen the attacks of the budworm. When smut is found on corn it should be cut off and destroyed to prevent its spread in the garden the following year.

CUCUMBERS

Cucumbers are sensitive to frost. They should not be planted until after the average date for the last frost in the spring. The soil preparation and fertilizers for cucumbers are about the same as for watermelons and cantaloupes.

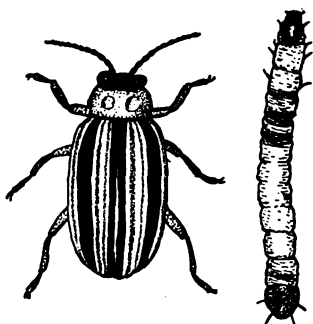
It is very important to fertilize and cultivate the crop so as to produce a rapid growth which makes crisp, tender cucumbers of high quality. A side application of

100 pounds of sulphate of ammonia, or about 140 pounds of nitrate of soda to the acre, as the plants begin to bloom, will be found helpful.

Rows for cucumbers should be from three and a half to four feet apart and the plants spaced three feet apart in the row. From six to eight seed are planted to each hill and the plants thinned to one or two to the hill after they are four or five inches high.

Cucumbers should be given frequent shallow cultivations.

Spraying Cucumbers.—Cucumbers should be



THE STRIPED CUCUMBER BEETLE AND "WORM"

sprayed as recommended for watermelons and cantaloupes. In regions heavily infested with the pickle worm, cucumbers should be grown and matured as early in the summer as feasible so as to harvest most of the crop before the insects become numerous. Spraying with arsenate of lead and lime mixture will be helpful, though will not control the pickle worm. If the

plants are kept covered with standard bordeaux mixture until mid-harvest season, attacks of mildew and other fungus diseases can be largely prevented.

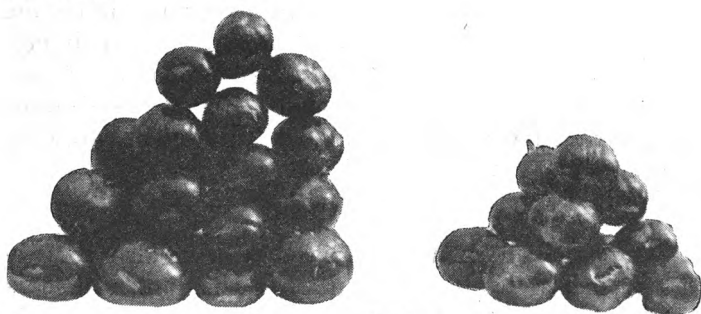
Harvesting.—For best quality, cucumbers should be harvested when they are only about half grown. Those produced for the market can be shipped in 24- or 32-quart hampers.

Early Cucumbers.—Extra early cucumbers should be started in pots or strawberry baskets filled with soil in hotbeds and carefully transplanted to the garden

after the weather becomes warm. Some growers follow the practice of growing the plants in hotbeds. With the approach of warm weather they remove the sash and allow the crop to mature in the hotbed.

EGGPLANTS

The culture of eggplants, including the starting of the young plants in hotbeds, fertilizing, and soil preparation is essentially the same as that given for peppers. The eggplant is possibly more sensitive to frost than any other crop commonly found in the garden. It is not advisable, therefore, to set eggplants in the spring until a week or ten days after tomatoes and peppers are put out. New York Improved and Black Beauty are good varieties.



COMPARATIVE YIELD OF IRRIGATED (*left*) AND NON-IRRIGATED (*right*)
EGGPLANT FROM THE SAME SIZE PLOT

Spraying Eggplants.—Eggplants should be sprayed with standard bordeaux mixture to which one pound of powdered arsenate of lead has been added for each fifty gallons. The plants should be sprayed in the seedbeds just before they are transplanted. They should be sprayed with the same solution every ten days or two

weeks after being set to the field to protect them from leaf spot and the potato beetle.

Number of Plants to Set.—Where the grower produces eggplants only for home use, ten plants will be sufficient. If he desires to ship his crop, from four to five thousand plants set on one acre of ground will produce a hundred crates or more.

Harvesting.—The fruit should be harvested when it reaches about one-half to two-thirds size. Where it is desired to ship eggplants the same crates or hampers used for shipping squashes will serve the purpose.

GARLIC

Garlic is a bulbous plant similar to the onion. Instead of forming one large bulb it forms several bulb-lets. The flavor of garlic is similar to that of onions except that it is a great deal stronger. Garlic is employed mostly in flavoring soups and stews and is grown by a limited number of gardeners. The same culture recommended for onions may be followed in growing garlic.

HORSERADISH

Grated horseradish root served with meats and oysters is prized by many families. The horseradish is easily grown. It will thrive in almost any good garden soil. A half dozen plants will be sufficient for a family. It is propagated from pieces of roots which may be obtained from a nursery or from a neighbor who has a few plants.

How to Plant and Cultivate Horseradish.—Where a surplus for sale is desired, the pieces of roots, which should be three inches long, are planted in rows about three and a half feet apart. The root pieces are

set about 16 inches apart and covered to the depth of about 2 inches. The planting may be done at any time from late fall to early spring. All the culture necessary is to keep down weeds and keep the horseradish from spreading to other parts of the garden. It is not difficult to destroy, but will spread if allowed to grow unchecked.

Harvesting Horseradish.—The roots are dug during the fall or winter. They may be washed, tied in bunches, and sold, or they may be grated and mixed with a little salt and vinegar and put away in jars for home use.

LEEK

Leek is similar to the onion. The leaves are flat, rather than round, like the onion. Its culture is practically the same, but it is cultivated largely as a summer vegetable.

The seed are usually sown in plant beds in the early spring and the plants set in the garden when they are four or five inches high. The plants are set rather deep and the soil worked to them at each cultivation. Leek has the mildest flavor of the onion group, while garlic stands at the other extreme.

KALE

Kale is one of the most resistant plants to cold found in the garden. It is used as greens in essentially the same way as mustard, spinach, and collards.

Kale requires a fertile soil and side applications of nitrogenous fertilizers for satisfactory crops. The seed should be planted in late summer or early fall, about the time turnips are planted. The rows are spaced 3 feet apart for horse culture, or 18 inches apart for hand

culture. The seed are sown continuous in the drill and the plants thinned out and used as they become large enough.



GEORGIA LETTUCE PACKED, ICED, AND READY FOR SHIPMENT

LETTUCE

Lettuce requires very fertile soil, cool weather, and a high degree of moisture for best development. In the lower South, where the winters are very mild, it may be planted in the late fall and grown for winter and early spring use. It requires from 60 to 70 days to grow a crop of lettuce.

In the middle and the upper South, lettuce may be grown as a spring crop or the seed may be planted in late summer about the time turnips are planted. The crop will mature and be consumed before freezing weather sets in. When the seed are planted in the spring it is important to plant them two or three weeks before the last spring frost is expected so as to mature the crop before hot weather comes. Lettuce planted during hot weather does not head well and goes to seed quickly.

Lettuce may also be planted in hotbeds in late fall and grown for winter use. Hotbeds for lettuce are constructed and prepared just as for starting tomato or pepper plants. For lettuce, however, the beds should be given more ventilation to hold down the temperature. A temperature of from 60° to 75° F. at night, and from 65° to 70° during the day is sufficiently warm for lettuce. Lettuce planted in hotbeds should be placed about ten inches apart each way.

Field Culture of Lettuce.—Lettuce plants may be started in seedbeds and then transplanted to the open soil, or the seed may be planted in rows where the crop is to grow.

The land is fertilized as for cabbage or celery and finely pulverized. The rows should be spaced about three feet apart for horse culture, and eighteen inches apart for hand culture. The seed are sown about one to the inch in the drill, and the plants thinned to a distance of about twelve inches apart when they are about two inches high. Where leaf lettuce is desired the plants may be allowed to grow without thinning, and pulled out and used as needed. Where lettuce is grown for the market the plants should be spaced twelve inches or more apart so as to develop large, symmetrical heads.

Varieties.—Good varieties of lettuce which produce firm heads are Big Boston, New York, Imperial F, Imperial 44, and Imperial 847.

Good loose-headed varieties are Early Curled Simpson, Grand Rapids, and Black Seeded Simpson.

Lettuce should receive rapid shallow cultivations and side applications of nitrogenous fertilizers to produce a rapid, tender growth.

Lettuce is sometimes attacked by a disease called "drop" which causes the entire plant to wilt and die.

Diseased plants should be pulled up and destroyed. The places where the diseased plants are pulled from should be saturated with standard bordeaux mixture.

Lettuce, for home use, may be harvested as needed, but any produced for the market should be allowed to develop firm heads before being cut. Lettuce is packed into hampers or crates and shipped by express or in refrigerator cars.

MUSTARD

Mustard is one of the favorites for both fall and spring greens in most southern gardens. The Southern Curled, a rather small growing variety, and the Chinese, a very large, rank growing variety, represent the two types commonly grown. Mustard may be planted in late summer or early fall for fall and winter use, and again about two weeks before the last spring frost for spring use. The culture for mustard is about the same as for turnips and kale.

OKRA

Okra is sensitive to frost and should not be planted in the spring until about cotton planting time. Soils and fertilizers well adapted to growing tomatoes are suitable for growing okra. The rows are laid off about three and a half feet apart, and the seed dropped two or three in a place about sixteen inches apart in the drill. The seed are planted almost on a level, and when the plants reach a height of three or four inches they are thinned to one or two in the hill. Where it is desirable to grow okra in large quantities the land is prepared and the seed planted very much in the same way as cotton is planted, except that a planter is used that will drop the seed in

hills. It requires about eight pounds of seed to plant an acre. The plants are cultivated in essentially the same way that cotton is cultivated.

Harvesting.—The pods should be kept closely cut to keep the plants bearing. Where it is desired to place okra on the market, 24-quart hampers are suitable for handling the crop. It is important that okra should be cut while tender, graded, packed, and delivered to the consumer as promptly as possible.

ONIONS

The onion requires a fertile, mellow, moist, though well-drained soil. It should contain sufficient sand or



A WHITE BERMUDA ONION PATCH

humus to be easily worked. It thrives best if planted at such a time that it will grow and mature its crop during cool weather.

The crop may be grown from seed or sets. It requires more care, skill, and hand work to grow onions from

seed than from sets, but onions grown from seed keep longer than those from sets. Commercial growers usually produce their crop from seed while the gardeners, who desire only a few feet of row space planted to onions, use sets.

Time of Planting Seed.—In the lower South the seed may be planted in late fall and the crop grown during the winter. In the middle and upper South, the seed are usually sown in the very early spring two or three weeks before the last spring frost is expected.

Planting Seed in Protected Beds.—Some growers plant onion seed in protected beds in midwinter and transplant the seedlings to the field as soon as spring opens. Before transplanting the young onions they are hardened off by taking the covers off the beds a few days before setting them in the open. In transplanting, about half of both the roots and tops are trimmed off.

Amount of Seed and Sets to Plant.—It takes from two to four pounds of seed to plant an acre. If sets are used, from seven to nine bushels are required.

Perennial Onions.—There are a few perennial types of onions grown under the names of Nest Onions, Multipliers, and Shallots, which are well suited to the home vegetable garden. These, especially the Shallots, are very early and produce green onions in late winter and early spring when other vegetables are usually scarce.

This group of onions should be planted in late summer or early fall and harvested as needed. As soon as the tops turn yellow in the spring these onions are taken up and the bulbs separated. One of these bulbs, when planted, will multiply and produce a bunch the following season.

Growing Onion Sets.—Onion sets are produced by sowing onion seed late in the spring. The seed should be sown very thickly on land only medium in fertility, so that the plants will mature only small bulbs on the approach of warm weather. These bulbs are harvested, spread in the shade to cure, and sold as onion sets.

Varieties of Onions.—The following are good, several-purpose varieties for growing from seed: Yellow Bermuda, Prize Taker, and Sweet Spanish; while Crystal Wax, Yellow Globe Danvers, and Red Weathersfield are good for growing from sets. The Bermuda onions are very generally grown in the Gulf Coast section.

Preparation of the Soil.—Unless the soil is already very fertile, it should have a broadcast application of a high-grade fertilizer mixture. This should be applied at the rate of from 1,500 to 2,000 pounds to the acre. Rows for horse culture should be about 30 inches apart, while those for hand cultivation should be about 15 inches apart. In either case the plants should be spaced about 3 inches apart in the row.

Cultivation of Onions.—Onions should be kept cleanly cultivated and should receive a side application of a nitrogenous fertilizer just before the bulbs begin to expand. Onions should be irrigated in dry weather if the grower has the facilities. The seed stalks should be kept pinched out so as to force the growth of the onion into the bulb.

When the bulbs are almost mature, their time of ripening can be made more uniform by mashing down the tops by running a light roller over them. This checks the top growth.

Marketing.—Some growers market onions in sacks, but slatted crates holding one bushel are preferable.

PARSLEY

Parsley is used for garnishing meats and for flavoring soups. It should be planted in the early spring at the same time that beets and radishes are planted. Only a small quantity need be planted in the home vegetable garden unless there is a market for the surplus. As the seed germinate slowly, they should be soaked in water for several hours before planting. They should be sown continuous in the drill and covered half an inch deep. When the plants are well started into growth they should be thinned to a distance of about six inches apart. The plants are quite hardy and may be allowed to remain in the garden all winter. Parsley runs to seed after it has withstood one winter and may then be removed for other crops.

PARSNIPS

The culture for parsnips is essentially the same as for carrots. The seed are sown in the early spring when beets are planted. The rows are placed about three feet apart for horse culture or eighteen inches apart for hand culture. The seed are sown continuous in the drill and covered about half an inch deep. When the plants are about two inches high they are thinned to a distance of about two inches apart.

Parsnips are quite hardy and may be allowed to remain in the open all through the winter in most sections of the South.

PEAS (Garden)

Garden peas, commonly called English peas, will stand considerable frost without injury. In the lower South it is often the practice to plant garden peas in the

late fall or early winter and mature the crop early the following spring. In the middle and upper South it is the practice to plant garden peas as the first garden crop to be planted in the spring. It is a common practice of gardeners to plant garden peas in double rows, planting two rows about ten inches apart and then leaving three feet between these and the next two rows. The seed are sown in the drill about one inch apart and covered about two inches deep.

Varieties.—The smooth seeded varieties will stand more cold than the wrinkled sorts, but the wrinkled varieties are of better quality.

Three good varieties are Alaska, Thomas Laxton, and Little Marvel.

Cultivation and Harvesting.—Garden peas require about the same soil and fertilizers as snap beans. The plants should be given frequent shallow cultivations until harvesting begins.

The crop should be harvested while the pods are fresh and green, yet well filled. Any surplus to be sold may be sent to market in snap bean hampers.

RADISHES

Radishes are resistant to cold and may be planted two or three weeks before the last spring frost is expected. The seed germinate very quickly and early varieties will often be ready to use in six or seven weeks after planting. Some gardeners mix radish with beet seed and sow them in the same drill. The radishes will germinate early and enable the gardener to follow the row in cultivating before the beets come up. The radishes also mature early and may be pulled up and used before the beets need the row space.

Rows for radishes should be only two or three feet apart for horse culture, and only sixteen inches apart for hand culture. The seed are sown continuous in the drill and covered about half an inch deep.

If radishes are desired over a long period successive plantings should be made about two weeks apart. Radishes become pithy in warm weather, and only a few should be planted at a time unless there is a sale for the surplus.

RHUBARB

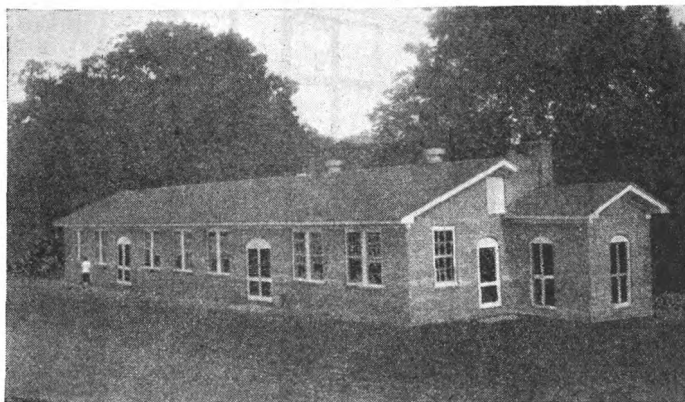
Rhubarb is not well adapted to the lower South. It thrives best in the mountainous sections, where the spring of the year is cool and moisture abundant.

Rhubarb requires a very fertile soil. In fact, the land can hardly be made too rich for this crop. It is propagated from pieces of roots very much in the same way that the horseradish is propagated. The plantings should be made in late fall, during the winter, or very early spring. The rows should be about four feet apart, and the roots planted about three feet apart in the row. Rhubarb should be kept free of weeds and grass by frequent shallow cultivations. Seed stalks should be broken out as they appear to prevent their sapping the vitality of the plant. Ten plants are enough for the average family.

Harvesting Rhubarb.—The thick leaf stems are the parts used. None of these should be cut until the second year after planting. There is a good demand for rhubarb in most city markets. Any surplus may be tied into bundles and sold. Rhubarb is used for sauces and pies, and in some sections is called the pie plant.

SALSIFY

The time for planting and methods for growing salsify are essentially the same as for carrots. The crop should be grown on very deep, friable soil so that the roots can grow long and straight without obstruction.

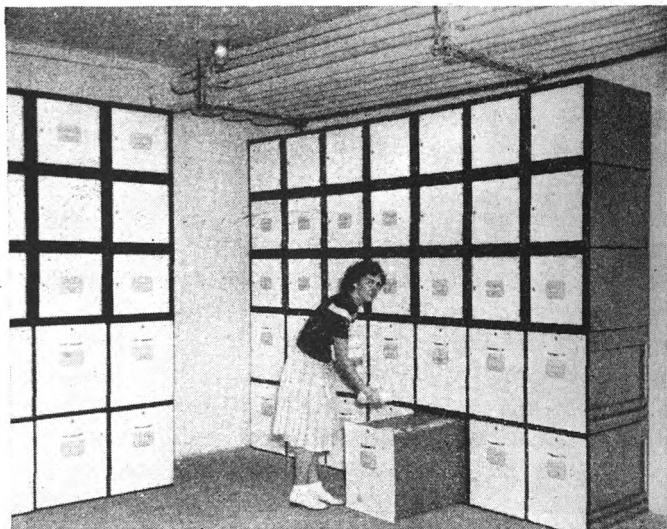


FOOD PROCESSING PLANT IN A VOCATIONAL HIGH SCHOOL

SPINACH

Spinach gives better results in the South if sown in the fall. Planted in the fall it affords a supply of salad all through the winter. It may be sown also during the latter half of February and makes a good crop of spring salad. Rows for spinach are laid out about three feet apart for horse culture, or about eighteen inches apart where the crop is to be worked by hand. The seed are sown continuous in the drill and covered about one-half inch deep. Spinach seed do not germinate quite so well as the majority of other garden seed. For this reason the seed should be sown thicker than the plants are in-

tended to grow. In harvesting spinach only the leaves are picked for use. Other leaves will grow out rapidly and so give a succession of pickings for a considerable period.



Courtesy of Georgia Department of Education

INTERIOR OF A FREEZER LOCKER PLANT

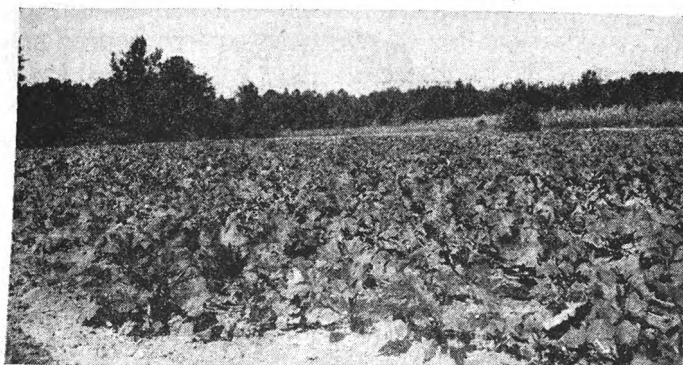
RAPE

While rape is frequently grown for poultry and pigs, it is, nevertheless, a splendid crop for production of greens in the garden. It is planted along with turnips, mustard, spinach, kale, and given the same culture which they require.

SQUASH

The squash is cultivated in practically the same way as cucumbers. It is sensitive to frost and should be planted late enough in the spring to escape cold injury.

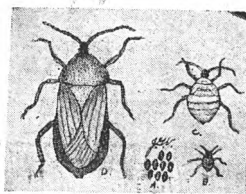
The bush varieties should be planted in hills three feet apart each way, while four feet apart each way is none too much for the running varieties. Yellow squashes represented by the yellow crook-necked variety are usually preferred to the white varieties.



FIELD OF SQUASH

Courtesy of Elmo Ragsdale

The Pickle Worm and Squash Bug.—The pickle worm attacks squashes very severely and no satisfactory method of control has been worked out to protect the crop from this insect. In heavily infested regions it is advisable to grow the crop as early in the summer as possible so that much of it can be harvested before the pickle worm appears in large numbers. The squash bug is also troublesome in some sections. About the only remedy for controlling this insect is to pick off and destroy the adult bugs when they first appear on the plants in the early summer.



SQUASH BUGS

(a) Eggs, (b) (c) young stages, and (d) adult.

Where crop rotation is practiced and squashes are grown in isolated fields the attacks of insects are less severe.

Harvesting and Marketing.—Squashes must be harvested while they are tender and when they are



EARLY SUMMER CROOKNECK SQUASH

The most popular commercially grown squash in the South.

hardly half grown. They may be marketed in 24- or 32-quart hampers, or in crates, 12 by 18 by 33 inches in size.

TURNIPS

The main crop of turnips is usually planted in late summer or early fall. However, a spring crop of turnips may be planted along with beets and radishes two or three weeks before the last spring frost is expected. Turnips require a fertile soil and should receive a side application of nitrate of soda or sulphate of ammonia when the plants are four or five inches high to stimulate rapid growth. Turnip rows should be spaced about three



A PATCH OF SHOGGIN TURNIP GREENS ALMOST READY FOR CUTTING

feet apart for horse culture, and eighteen inches apart for hand culture. The seed are sown continuous in the drill and covered about half an inch deep. It takes from two to four pounds of seed to sow an acre.

Rutabagas require a longer time for maturity than most varieties of turnips. The seed for these should be sown in early or midsummer, and the plants thinned to a distance of three inches apart when they develop their second pair of leaves. The green cabbage worm, which attacks rutabagas, may be killed by dusting the plants with calcium arsenate or arsenate of lead mixed with lime.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. Where should the vegetable garden be located?
2. How may soils be made suitable for the vegetable garden?
3. What size should the farm vegetable garden be made?
4. What class of vegetables need most sunlight?
5. What tools are needed for taking care of the garden?
6. What kind of seed can the gardener best save at home?
7. What care should be taken in buying garden seed?
8. How does a garden plan aid in determining the quantity of seed to buy?
9. Why should the grower buy more seed than are required to plant the garden one time?
10. How do the planting dates given in the planting table differ from the dates for planting in your community?
11. How is compost made and for what is it used?
12. What are some of the advantages of starting plants indoors or under glass?
13. How are window boxes prepared for starting plants?
14. Name some of the uses of hotbeds.
15. Why is one fertilizer mixture used for the entire garden?

16. Why are animal manures desirable for the garden and how much would you use?
17. What kind of commercial fertilizers and how much would you use for the vegetable garden?
18. How often should the garden be fertilized?
19. How often should the garden be limed and how much lime should be applied?
20. How would you prepare the garden soil for planting?
21. Why are some garden seed planted on ridges?
22. Name some of the cool season plants and some of the warm season plants which should be planted first in the spring?
23. From the planting table and map divided into zones, determine the planting dates of garden vegetables in your warm season plants. Which should be planted first in your community?
24. What spray outfit would you buy for the home vegetable garden?
25. What spray materials would you buy for a one-fourth acre garden?
26. What are some of the important spray mixtures used for spraying vegetable plants?
27. How are the spray mixtures prepared?
28. For what are arsenate of lead mixtures used? Nicotine sulphate? Bordeaux mixture?

SUGGESTED EXERCISES

1. Visit several vegetable gardens in your community and record the different kinds of vegetables you find growing in the different seasons, as fall, winter, spring, and summer. Suggest improvements and other vegetables which should be grown.
2. Draw a plan for a home vegetable garden suitable for your own family. Select the varieties you desire and the quantities of seed of each necessary for planting the garden you have planned. Give the planting date for each vegetable you would grow.

3. Secure a seed catalogue and make out an order for the seed necessary to plant the garden you have planned.
4. Make a collection of garden seed and learn to identify each without the labels.
5. Construct a window box, fill it with soil, and plant several different kinds of garden seed in it. Note the time required for each kind of seed to germinate and learn to name the different kinds of plants as soon as they come through the soil.
6. Construct a hotbed on the school grounds and use it for growing winter vegetables as well as for starting plants for early spring planting.
7. If space is available establish a vegetable garden on the school grounds. Vegetables from the garden may be sold and the proceeds used for the school.

SEASONAL WORK FOR THE GARDEN

The following suggested seasonal work for the garden should be modified according to latitude and seasonal variations.

September, October, and November

Seed of such crops as turnips, mustard, lettuce, spinach, and carrots may be planted for a fall garden.

Start lettuce in hotbeds for winter use and put out onion sets. Cabbage seed for the production of plants for the next season should be sown about two weeks before frost.

Save seed of such plants as beans, okra, cucumbers, tomatoes, and squash. Make a compost of autumn leaves, barnyard manure, and soil.

Continue to cultivate growing vegetable crops up until frost.

As cold weather approaches, harvest large green tomatoes and allow them to ripen indoors. Throw soil up to rows of turnips, carrots, and other root crops, with a turn plow if freezes are common in the region.

December, January, and February

Draw a plan of the garden and write for seed catalogues. Select varieties and quantities of seed according to the plan

of the garden. Place an order for seed and plants early.

Give entire garden a coating of stable manure.

Plant hardy cabbage plants, asparagus crowns, horseradish and rhubarb roots.

Repair hotbeds and cold frames in readiness for starting early tomato, pepper, and eggplants. Provide a supply of horse stable manure for the hotbeds.

Begin planting English peas, spinach, beets, turnips, and other hardy plants in the lower South.

March, April, and May

Begin active work in the spring garden. Prepare and fertilize the soil and plant such cool season crops as turnips, beets, radishes, Irish potatoes, etc.

When the danger of spring frost has passed, plant such crops as cucumbers, squashes, and beans, and set out plants of tomatoes and peppers.

Begin cultivation and spraying against insects and diseases as soon as the plants are well started into growth.

June, July, and August

Continue to cultivate and spray to keep the crop free of weeds and to protect them against insects and diseases. Prune and stake tomatoes and stick pole beans.

Harvest and utilize each of the crops as they mature.

Put side applications of fertilizers around plants where needed. Irrigate in dry weather if a supply of water is available.

Put out multipliers and shallot onions, and sow rutabaga turnip seed.

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CHAPTER XLIV

BEAUTIFYING THE HOME GROUNDS

Job 1—Making the Plans

The first step in beautifying either public or private grounds is to make a detailed plan of all improvements and plantings to be made. The plan should be drawn to a scale so far as boundary lines, walks, drives, fences, and outlines of buildings are concerned. The location of each tree, each clump of shrubbery, and each bed of herbaceous flowering plants should be shown as accurately as possible, even though this part of the plan may be sketched in freehand.

With such a plan as a beginning, the home owner or one charged with beautifying public grounds can start the work with very little equipment and limited facilities. A part of the soil can be prepared and only a few plants purchased and set at a time if necessary. As time and funds become available for making further improvements, the original plan can be followed in making every additional planting. Even though the work may extend over a period of several years, it will be a well ordered, complete job when it is finished.

Kind of Plan to Use.—Either of two distinct types of plans may be used: (1) the formal plan and (2) the natural plan. The formal plan is symmetrical in every respect, and is laid out in squares, rectangles, diamonds, or circles, and sometimes ornamented with various kinds of statues and figures. Such a plan is adapted to a city park, court house grounds, and sometimes to the city

home, but not to the rural home or school. Here the natural plan serves better. No one but an experienced landscape architect should attempt the formal plan.

The most common error is to over-crowd the plantings. This prevents natural spread and development of the plants and often obstructs distant views of hills, streams, or fields, which are most desirable. It is often advisable to remove limbs of trees or other objects which obstruct such views from a window or some favorite place on the porch.

Knowledge of Plants and Materials Necessary in Making the Plan.—A thorough knowledge of plants and materials is necessary in obtaining correct proportions and harmony of colors. One should be familiar with the color of the foliage and the flowers, and the time of blossoming and the shedding of the leaves of the various trees and plants to be used for improving the landscape. He should know, also, the natural shapes, sizes, cultural requirements, and longevity of the plants he desires to use. With this knowledge, he can so group his plants as to blend the colors, producing a pleasing effect. Helpful information along these lines can be obtained from experiment stations, agricultural colleges, and from reliable nurserymen. In addition, the prospective planter should visit well improved parks and home grounds where he will have an opportunity to study individual trees and plants as well as landscape designs.

Groups of Plants to Use in the Plan.—The plants used in a landscape plan may be divided into five general groups as follows: (1) *trees*, usually large and tall with a main trunk or stem; (2) *shrubs*, bushy plants, not having well-developed main stems; (3) *vines*, trailing

or climbing plants; (4) *herbaceous and flowering plants*, grown for their flowers; and (5) *lawn grasses*.

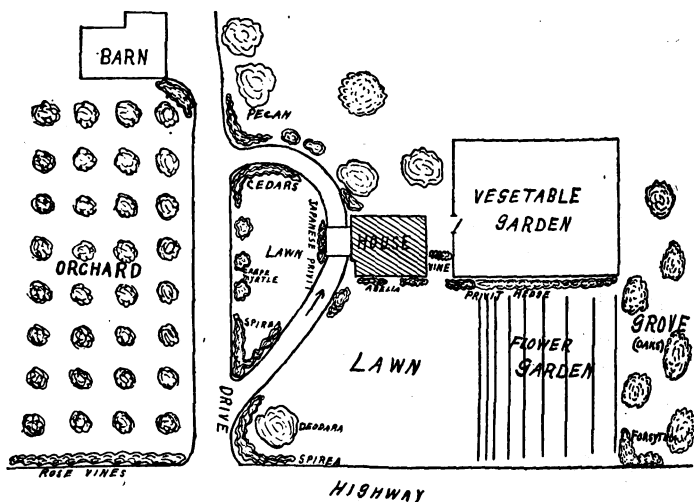
Trees.—Trees serve to beautify the landscape and produce convenient shade during the summer. In addition, they lend attractiveness and grace to the grounds in winter. They also give a distant view or “approach” to a building, if properly grouped. Often a tree can be used to hide an unattractive corner of the house or make some desirable feature stand out.

Trees should be selected to conform to the type of the building. Tall growing trees, as Carolina poplars, Lombardy poplars, and some of the shaft-like cedars, should be planted near low, flat buildings so as to counteract the flatness of the building. Tall buildings should be accompanied by spreading trees, such as oaks, elms, and some of the maples. The height of the building will blend with the height of the trees and be less conspicuous.

Two Groups of Trees.—There are two general groups of trees which may be used: (1) deciduous, or those that shed the leaves in winter; and (2) evergreens, those that remain green all winter. Deciduous trees are, in many respects, the more desirable of the two. They produce shade during the summer and admit sunlight in winter. This is of advantage because it not only makes a change of scenery from summer to winter, but allows lawn grass to grow beneath the trees in winter. Deciduous trees may be used in either the front or back yard, and may be planted either in groups or solitary. Trees that do not bear edible fruits, such as elms, oaks, maples, red bud, Lombardy poplars, and beech, should be placed towards the front of the house. Fruit trees, such as hickories, pecans, pears, honey locusts, mulberries,

peaches, apples, figs, and cherries, should be confined to the back yard.

Evergreen trees, such as cedars, junipers, pines, magnolias, and laurels, are necessary for color and foliage in winter. They may be set in groups, or alone, depending on the kind of tree used. The broad leaf evergreen trees such as magnolias and laurels, should be set in a separate group from the slender-leaf evergreens such as the cedars, junipers, and pine. Any of these trees may be used directly in front of the buildings or slightly to one side, rather than in the back yard. Various types



A PLAN FOR BEAUTIFYING A HOMESTEAD

Note the open lawn, the curved driveway, and the clusters of shrubs.

of cedars, junipers, and pines may be attractively arranged along the borders of the lawn, but occasionally it is permissible to use one in the center of the lawn.

The following table gives a few of the trees suitable for ornamental plantings under southern conditions.

TREES

Botanic Name	Common Name	Height in Ft.	Remarks
<i>Acer rubrum</i>	Red Maple	60 to 70	One of first trees to bloom in spring. Attractive red flowers and seed
<i>Acacia</i>	Mimosa	20 to 30	Spreading tree with sensitive, delicate foliage and pink flowers
<i>Cornus Florida</i>	Flowering Dogwood	12 to 25	Trees adapted to semi-shade and produces large, white, showy flowers in early spring
<i>Cersis canadensis</i>	Red Bud	12 to 25	A spreading tree with attractive red flowers in early spring
<i>Hicoria</i>	Hickory	75 to 100	The hickories and pecans are ornamental trees with wide ranges of adaptability
<i>Ilex opaca</i>	Holly	20 to 50	Beautiful evergreen with attractive red berries in winter
<i>Laurocerasus caroliniana</i>	Cherry Laurel	20 to 40	Spreading evergreen tree with dark blue berries in winter
<i>Magnolia grandiflora</i>	Magnolia	60 to 80	Evergreen tree with large dark green foliage. Produces large white flowers in early summer
<i>Quercus alba</i>	White Oak	50 to 100	One of the most beautiful and drought resisting of the oaks
<i>Quercus nigra</i>	Water Oak	40 to 60	Good tree for shade. Leaves small and not troublesome when dropped on lawns
<i>Quercus virginiana</i>	Live Oak	80 to 100	An evergreen oak well adapted to coast country of lower South
<i>Ulmus</i>	Elm	50 to 80	Good shade trees widely adapted
<i>Fagus</i>	Beech	50 to 80	Dense shade tree widely adapted

TREES (Conifers)

Botanic Name	Common Name	Height in Ft.	Remarks
<i>Cedrus deodara</i>	Deodar Cedar	20 to 40	Blue-green in color, fine foliage, conic in shape, one of the best for group and individual planting
<i>Juniperus</i>	Red Cedar	50 to 75	Pyramidal in shape, bronze-green in color and hardy
<i>Libocedrus decurrens</i>	California Incense Cedar	80 to 100	Tall, shaft-like grower, dark green, very desirable as individual specimens
<i>Pinus palustris</i>	Longleaf Pine	80 to 100	Adapted to the Coastal Plain. Bright green and handsome when grown as individual specimens
<i>Pinus strobus</i>	White Pine	60 to 90	Beautiful dark green pyramidal pine. Well adapted to upper Piedmont and mountain sections
<i>Pinus taeda</i>	Old Field Pine	50 to 100	Bright green spreading pine. Well adapted to most of South
<i>Thuja orientalis</i>	Tall Golden Arborvitae	20 to 50	Tall, yellow-green arbovitae, widely adapted
<i>Tsuga caroliniana</i>	Carolina Hemlock	50 to 75	A dark green spreading evergreen well adapted to Piedmont regions

Shrubs.—When properly selected and placed, shrubs add more to a landscape than any other group of plants. The chief purpose is that of blending the horizontal plane of the ground or lawn with the vertical plane of the wall of the house or trees, thus forming a curvature. Consequently, they should be planted generally around the borders of buildings or about the outskirts of the limbs of trees. They should be planted also in the corners of driveways where there is not room for trees.

Shrubs should be planted in groups of from three to twenty or more. It is better to use a large number of a few kinds than a few each of many different kinds. A group may consist of from two to twelve kinds, the tallest near the center with the lower growing plants forming the border.

Shrubs may be planted as a hedge to take the place

NATIVE SHRUBS

Botanic Name	Common Name	Height in Feet	Season of Bloom	Color Bloom	Rate Growth	Remarks
<i>Azalea nudiflora</i>	Pink Honey-suckle	6 to 8	Sp.	Pk.	S.	Good for base and border planting, showy. Thrives on acid soil
<i>Calycanthus floridus</i>	Sweet Shrub	3 to 6	Sp.	R.	R.	Fragrant. Good for borders
<i>Cretagus</i>	Hawthorn	5 to 25	Sp.	W.	S.	Several species. May be used for clump or singly
<i>Euonymus americanus</i>	Brook Euonymus	3 to 6	Sp.	W.	R.	Semi-evergreen, fruit red, good for base and border plantings
<i>Ilex glabra</i>	Gallberry	3 to 6	Sp.	W.	S.	Evergreen, fruit dark blue, good for base and border plantings
<i>Kalmia</i>	Mountain Laurel	3 to 8	Sp.	Pk.	S.	Evergreen, group and border plantings. Thrives on acid soil
<i>Myrica carolinensis</i>	Bayberry	3 to 8	Sp.	W.	S.	Evergreen, good for border and screen plantings near coast
<i>Rhododendron</i>	Rhododendron	5 to 20	Su.	M.	S.	Evergreen, good for bordering lakes and streams. Tolerates acid soil
<i>Sambucus canadensis</i>	Elder Berry	8 to 12	Su.	W.	R.	Handsome. Good for group planting. Attracts birds
<i>Biburnum prunifolium</i>	Black Haw	10 to 15	Sp.	W.	S.	Border, handsome flower, leaf, and fruit
<i>Yucca filamentosa</i>	Bear Grass	1	Su.	W.	S.	Base or border. Tall flower stalk 6 to 8 ft.

of a fence, to protect the inclosed yard, or to hide unsightly objects.

There are both deciduous and evergreen shrubs. Of the deciduous or flowering kind, there are several spi-

IMPORTED SHRUBS

Botanic Name	Common Name	Height in Feet	Season of Bloom	Color Bloom	Rate Growth	Remarks
<i>Abelia grandiflora</i>	Abelia	3 to 6	Su.	Pk.	R.	One of the best for base plantings
<i>Buxus sempervireus</i>	Boxwood	1 to 15			S.	Border and formal plantings. Evergreen
<i>Forsythia</i>	Golden Bell	4 to 10	Sp.	Y.	R.	Group and border planting
<i>Gardenia florida</i>	Cape Jessamine	3 to 8	Su.	W.	S.	Used for border plantings. Very fragrant. Subject to white fly
<i>Lagerstroemia indica</i>	Crape Myrtle	10 to 30	Su.	Pk.	R.	Pink, red, and white varieties. Good for border and group plantings
<i>Philadelphus</i>	Mock Orange	4 to 10	Su.	W.	R.	Showy, fragrant, good for base and border plantings
<i>Prunus glandulosa</i>	Flowering almond	4 to 5	Sp.	R.	R.	Showy, good for border plantings
<i>Spirea Thunbergi</i>	Thunberg's spirea	5 to 5	Sp.	W.	R.	One of the first to blossom in spring. Good for base and border plantings
<i>Spirea Van Houttei</i>	Bridal Wreath	4 to 6	Sp.	W.	R.	Good for base and border plantings. One of the best
<i>Weigelia rosea</i>	Weigelia	4 to 6	Sp.	Pk.	S.	Showy, good for base and border plantings
<i>Ligustrum</i>	Privets	6 to 20	Sp.	W.	R.	The Japanese and Amoor river privets have dark evergreen foliage and are well suited to hedge and border plantings
<i>Euonymus japonicus</i>	Burning Bush	4 to 8	Su.	W.	S.	An evergreen used for hedge, base, and border plantings. Subject to scale

reas, weigelia, deutzia, philadelphus, forsythia, flowering almond, hardy orange, and the flowering peach. These are grown mainly for the flowers, which sometimes appear in great masses of yellow, white, pink, red, or a variety of colors. The evergreen shrubs, such as euonymus, Japanese privet, amoor river privet, barberry, abelia, *Elaeagnus*, boxwood, holly, and mountain laurel, may produce flowers but are grown chiefly for their attractive foliage. It is best to place evergreen shrubs in the background of a cluster and deciduous shrubs in the foreground. These are the plants usually used for hedges in order to be effective all the year.

The foregoing are a few of the more desirable shrubs which are in common use.

Vines.—Vines add grace and beauty to a scene that cannot be had otherwise. They may be used to give a tone of quietness or seclusion to a yard that is considerably exposed to the public view.

Vines may be trained to run around the base of buildings, on trees, or on various types of trellises. The Scuppernong vine, trained to a white arbor is an ornament to the back yard. Wisteria, kudzu, honeysuckle, Virginia creeper, English ivy, or climbing roses may be trained either to the house or an arbor built for the purpose. For the back yard, the same kind may be used with the addition of the following to the list: morning glory, gourds, lima beans, and other annuals. Vines must be properly trained to be attractive. They may or may not become a permanent part of the landscape. They may be planted and later removed and the original beauty of the trees or shrubs left unmarred.

It is not advisable to train vines to wooden houses, though often the protection given the house from the hot summer sun more than counteracts the rot caused by the

dampness of the vine. In this case, poultry wire may be put on a frame erected about one foot from the house parallel to the wall and the vine trained on it. In this way the house will be protected from the sun and will not be made damp by the vine. Evergreen vines are commonly used to cover bare rock or brick walls and to trail about rock pillars.

Herbaceous and Flowering Plants.—This group includes hundreds of kinds and scores of colors. They may be planted around the base of buildings, along the walks, or along one edge of the lawn, but by far the best place is in a flower garden. With the many new kinds that are now available they should be included in any plan of beautifying the home.

Flowers may be divided into two groups: (1) annuals and (2) perennials. The annuals last but one year and must be grown from the seed each year. They include such plants as sweet peas and nasturtiums. These are used largely for cut flowers and are not considered a permanent part of the landscape.

The perennials include the snapdragons, chrysanthemums, peonies, narcissi, iris, violets, and many others. They live over winter, putting out new growth each spring. These plants may be arranged to produce a mass effect and become a part of the landscape proper. However, if they are to be grown for cut flowers they should be planted in rows where good culture can be given.

The flower garden constitutes the most beautiful spot about the home at blooming time, but may be unattractive when not in bloom. Flowering plants should be so selected as to give a succession of flowers for a greater part of the year.

For early spring flowers such plants as violets, nar-

cissi, hyacinths, tulips, and pansies may be used. These are followed by iris, roses, sweet peas, peonies, sweet williams, pinks, and larkspur. With midsummer come the zinnias, lilies, nasturtiums, hollyhocks, gladioli, sunflowers, cockscomb or Prince's feather, and snapdragons. In the fall, roses bloom again and are accompanied by such flowers as dahlias, chrysanthemums, cosmos, and asters.

The Lawn.—The lawn is the foreground and foundation of the entire landscape picture. It gives softness and delicacy to a scene that would otherwise be hard and rigid. A carpet of green, soft grass is a thing of beauty.

The lawn should contain as few walks and drives as possible, and in no case should trees, shrubs, vines, or herbaceous plants be allowed to occupy the center of the lawn. It should be open and as extensive as feasible, both to facilitate caring for it and to add depth and beauty to the picture.

Two drives or walks through or around the lawn are permissible. One may be a service road leading straight from the highway to the back of the premises. The drive or walk to the entrance of the home should be gracefully curved. The drive or walk should be a little below the general level of the grass on the lawn so as to expose the bare ground as little as possible when taking a side view of the entire landscape.

Job 2—Procuring the Plants and Seed for Ornamental Plantings

After completing the plan, the next step is to procure the plants and seed called for in the plan. There are three ways in which these may be provided: (1) they

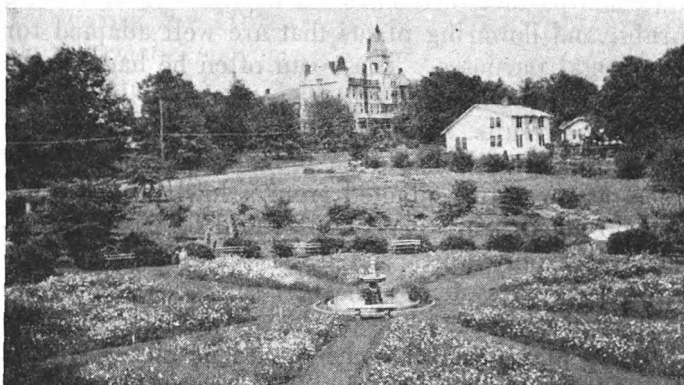
may be purchased from nurserymen and seedsmen, (2) they may be propagated at home, or (3) they may be collected as native or wild plants.

Purchasing Plants and Seed.—It is not usually feasible to get all the plants and seed needed from any one of these sources. Such plants as do not grow wild nearby or cannot be conveniently propagated at home should be purchased from the nearest reliable nurseryman selling good plants at reasonable prices.

In placing an order for ornamental plants it is important to be definite, stating the number, size, variety, or species desired. If a quantity of plants are to be purchased, and the nursery is not too far away, it is far better to visit the nursery and personally select the plants. In this way good specimens of plants can be selected to fit particular places in the landscape as planned. It is not a good plan to accept very many substitutions in an order. If the nurseryman is unable to supply the plants desired, it is better to go elsewhere for them than to change materially the plan of the landscape.

Nursery trees are frequently ordered months in advance of the time of delivery. To take care of such early orders the nurseryman goes through his nursery and marks special plants as sold, to fill them. In case he has a shortage of certain species the late orders necessarily are unfilled or substitutions are made. This emphasizes the necessity of sending in orders for plants well in advance of the time they are needed. The same care and precaution should be observed in ordering bulbs and seed for flowering plants and for lawns from seedsmen as in ordering nursery trees. Seed and bulbs are sent through the mails and may be ordered twice each year, in the winter for spring use, and in the summer for fall planting.

Propagating Plants at Home.—It is not advisable that each person desiring to improve his grounds attempt to propagate all the plants he will need. However, it



Courtesy of G. C. Starcher

A WELL-LANDSCAPED PARK

is well to have a plant bed located somewhere to the rear of the building in which seedlings of flowering plants can be started in the early spring. It is necessary to start the annual plants from seed each year, but the perennials, when once established, will last indefinitely. It is well, also, to maintain a small area for rooting cuttings of privet, boxwood, roses, and various other shrubbery. Cuttings of these may be rooted just as cuttings of figs and grapes are rooted.

Where time and quick results are not such an important factor, a number of our important ornamentals, such as the deodara cedar, aborvitae, and magnolia, may be started from seed planted in seedbeds and later transplanted to a nursery row in the garden or elsewhere. A convenient supply of water is very essential

in taking care of the nursery plants of all kinds during periods of dry weather.

Wild or Native Plants.—Nearby woods, hedge rows, and pastures often abound in wild or native trees, shrubs, and flowering plants that are well adapted for ornamental purposes. These can often be had for the digging and should be used wherever they will produce the desired results. Native trees and shrubs to be planted on an upland soil should be brought from an upland place, as those transplanted from a lowland to an upland do not thrive. The plant should be hardy, vigorous, free from insects and diseases, and have a well developed root system. The best time to select such a plant is in summer, while the leaves are on. If it is a flowering plant, the blossoms should be observed also. If a plant is selected as suitable for a certain place in the landscape it can be marked by tying a piece of cord or cloth to it so that it may be found easily at the proper time for transplanting. It may be time well spent to take a trip through the woods every few weeks in summer in search of such plants.

Job 3—Preparing the Soil and Making the Plantings

After plans have been drawn and all trees, shrubs, and vines have been ordered, tools should be assembled and the ground prepared to receive the plants. If any grading is needed it should be done first.

Grading.—Small amounts of grading can be done with a wheelbarrow, pick, and shovel; but if there is a large amount of soil to be moved a team with a plow and scoop will be needed. It is best to grade while the soil is fairly dry in order to prevent the extreme har-

dening that follows grading wet soil. When the operation is finished, the subsoil is usually exposed on the surface. All such places should be covered from four to six inches in topsoil from a nearby field.

Digging the Holes.—In digging the holes for the plants a spade, shovel, and crowbar will be needed. In taking the soil from a hole two piles should be made of it, placing the topsoil in one and the subsoil in the other. The hole should be large enough to hold all of the lateral roots without crowding and deep enough for the plants to stand a few inches deeper than they were before being dug.

Fertilizing the Trees.—If the trees are to be fertilized at the time of planting, a small quantity of bone-meal or similar fertilizer should be mixed thoroughly with the topsoil before it is put around the roots of the tree. Horse or cow manure is just as good and probably less liable to cause injury to the young tree than commercial fertilizers. Avoid letting strong fertilizer or manure come in direct contact with the tree roots. If the soil is fairly fertile it is safer not to use any manure at all at the time of planting. The first aim is to get the tree or shrub to live, then to make it grow.

Transplanting.—The best months in which to transplant trees or shrubs are December and January, when they are completely dormant. A circle should be made around the tree about two feet away, and a trench dug on the outside of the circle. The trench should be dug from one to three feet deep, gradually working inward to undermine the roots with the adhering soil. Finally, the entire root system, including the taproot, should be cut. The tree should be loaded on a truck or wagon and carried to the hole where it is to be set, with as much soil adhering to the roots as possible. If it is a dry,

windy day, wet sacks should be spread over the roots to prevent evaporation of the moisture.

Setting the Trees or Shrubs.—When setting trees from the woods or from the nursery, the tree should be placed in the hole carefully without breaking, splitting,

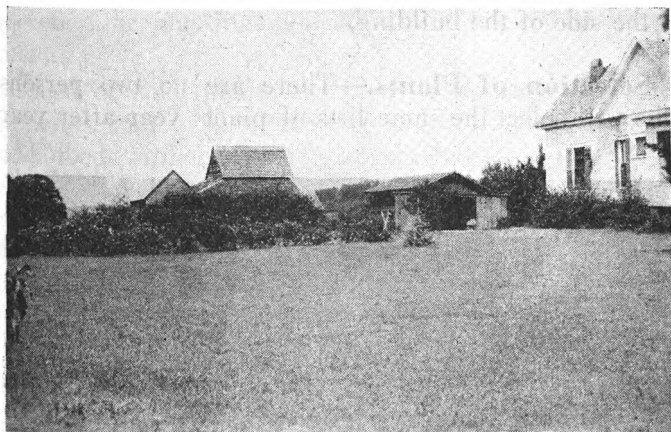


A HOME NOT LANDSCAPED

or knocking off the bark of the roots. While it is being held in the center of the hole fine soil should be sprinkled over the roots, using topsoil for the bottom. The soil should be made firm around the roots by stepping on it. Rocks, clods, sticks, or anything that would cause large air spaces should not be allowed to come in contact with the roots. When the hole is full the soil should be vigorously stepped on to make sure that it is firmly packed around the roots. Then a few inches of loose soil should be put around the tree.

Cutting Back Newly Set Trees and Shrubs.—When the tree is in place, all broken or bruised limbs should be cut off and trimmed to the desired shape. The amount of top to cut depends on the amount of root that

was lost in transplanting. If from one-third to one-half the root system is cut off in the process of transplanting, from one-third to one-half the top should be removed to keep a balance between the roots and the branches. It is better to thin out and prune back the branches of



Courtesy of H. W. Harvey

THE SAME HOME AS SHOWN IN THE PREVIOUS FIGURE AFTER BEING
LANDSCAPED

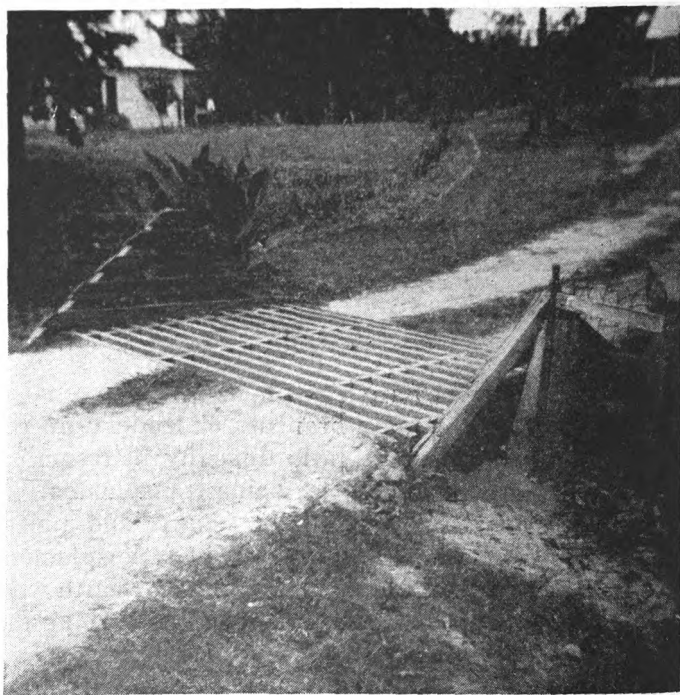
trees and shrubs as they are transplanted, than to remove the entire top. If the main branches or leaders are reserved, the plant will have little difficulty in resuming promptly its normal shape after being transplanted.

Evergreens, such as arborvitae, cedars, and pines, should be cut back very little, if any, when transplanted. This is obviated by taking up a large ball of earth with the plant in moving evergreens and thus disturbing the root system very little.

Making the Flower Garden.—Soil for the flower garden should be very fertile and loamy enough to be worked easily. It should be fertilized and prepared

very much in the same way that soil for a vegetable garden is treated. The area may be divided into beds or rows to suit the convenience and tastes of the owner. However, where the flower garden is to become a part of the general landscape of the premises, it should be located as a border to the lawn, usually in the rear or to the side of the building.

Selection of Plants.—There are no two persons who will select the same lists of plants year after year



Courtesy of H. W. Harvey

**VIEW OF HOME-CONSTRUCTED CATTLE GUARD TO KEEP CATTLE OFF
GROUNDS WITHOUT THE USE OF GATES**

for growing in the flower garden. Here, again, the wishes of the individual must be considered. As a rule, perennials are preferable to annuals for the reason that they do not have to be planted each year and require somewhat less attention. It is well, however, to have some of each for this gives the grower an opportunity to rotate the plantings and add to the variety or assortment.

Seed of such plants as coleus, snapdragons, salvia, petunias, and pansies, may be grown in window boxes or hotbeds in the very early spring and the young plants set to the flower garden as soon as outdoor conditions are favorable. The same general principles which are followed in the transplanting and culture of garden vegetables may be followed in the transplanting and care of flowering plants. Each should be given sufficient distance for normal development and for their easy cultivation.

It often becomes necessary to take up and divide such perennials as bulbs, dahlias, gladioli, iris, and others in late summer or fall. In resetting these it is preferable to plant them in another place. If they are to be set in the same beds the soil should be broken deeply and heavily fertilized as soon as they are taken up for division.

Making the Lawn.—The first step in making a lawn is to grade carefully and smooth the soil. Fertile surface soil should be reserved during the process of grading or hauled in from some other place to cover the places where the subsoil has been left exposed during the process of grading. The next step to be taken is to make the soil fertile in order to get a satisfactory growth of lawn grass. This may be accomplished by the use of well decomposed stable or barnyard manure which has

been allowed to decay long enough for the greater number of noxious weed seed in it to have germinated or decayed. The stable manure should be supplemented with a commercial fertilizer mixture and also with lime, unless the lawn is to be made in a limestone region. For each 100 square yards of soil there should be applied about 800 pounds of stable manure, 20 pounds of an 8-4-4 fertilizer mixture, and 40 pounds of air-slaked or hydrated lime. The stable manure and fertilizer mixture should be applied broadcast on the surface of the soil and then plowed under. The lime should be spread broadcast over the freshly plowed soil and harrowed or raked into the surface as the soil is being smoothed in preparation for sowing the grass seed.

Sowing the Grass Seed.—In establishing a lawn, great care should be taken to get grasses adapted to the region. The St. Augustine grass is well suited for lawns in the warmer sections of the lower South where severe winter freezes seldom occur. This region extends along the Atlantic Coast from eastern Georgia through Florida and over on the Gulf Coast through Louisiana.

Bermuda is the standard summer lawn grass practically all through the middle South. The Kentucky blue grass is well adapted to the upper South, especially in those regions where the soil is rich in lime. Perennial rye grass and Italian rye grass may be used practically all over the South if sown in the early fall to produce green lawns through the winter. Seedsmen frequently make grass and clover seed mixtures for lawns. These mixtures vary in composition but generally include some or all of such well known grasses as the Kentucky blue grass, creeping bent grass, meadow fescue, red top, bermuda grass, and also white clover. Zoysia is a new grass of promise. It is propagated only by plants.

The bermuda and St. Augustine grasses are usually established in the early spring by planting pieces of sod or turf only a few inches apart. The other grasses mentioned and white clover are generally grown from seed sown either during the fall or very early spring. The amount of seed necessary for producing a thick lawn sod will depend upon the size of the seed. Such large seeded grasses as the Italian rye grass or perennial rye grass will require from two to two and one-half pounds for each 100 square yards of lawn to be sown. The smaller seeded ones, such as meadow fescue, Kentucky blue grass, white clover, and the various lawn grass mixtures, will require about one and one-half pounds to sow 100 square yards.

It is very important to sow lawn grass seed as evenly as possible. A very good practice is to divide the quantity of seed to be sown in two equal parts. Sow one-half of them over the soil in one direction, and then sow the other half over the same area at right angles or across the direction of the first sowing. The seed should be scratched into the surface of the soil with a light, fine-tooth harrow or a steel rake, covering them from one-fourth to one-half inch deep. After the seed are thus covered, the soil should be rolled with a light roller which smooths the surface and compacts the soil. This produces conditions favorable to seed germination.

When the lawn grass reaches a height of four or five inches it should be mowed. The mowings should be repeated as frequently as the grass reaches this height.

Lawn grasses showing a lack of vigor can be stimulated to more active growth by giving a broadcast application of one or two pounds of nitrate of soda or sulphate of ammonia to each 100 square yards during the growing season. It is well to water the lawn immediately after putting on the nitrate of soda.

Job 4—Caring for the Plants

The proper care of ornamental plants involves (1) watering, (2) cultivating, (3) pruning, (4) fertilizing, and (5) protecting them against insects and diseases.

Watering the Plants. — Transplanted trees and shrubs, as well as herbaceous flowering plants, have large parts of their roots and branches cut off during the process of transplanting. This makes them far less resistant to dry weather for the first year or two or until they are well established in their new location. Consequently, it is very important for them to be watered during dry weather.

Trees and shrubs should be watered every three or four days during hot dry weather the first year after they are planted. Probably once a week is often enough to water during long droughts the second year. It is better to soak the soil about a tree or plant occasionally than to sprinkle it often.

In watering trees and shrubs a trench about five inches deep should be dug in a circle about a foot from the plant. Water should be poured into this trench as it soaks into the soil, until about five gallons has been applied, or enough to soak the soil thoroughly as far down as the roots of the plant extend. After the water has soaked in, the trench should be filled with dry soil left loose on top.

Whether or not plants need watering can be determined by the wilting or rolling of the foliage and by the dryness of the soil four or five inches below the surface.

Cultivating. — Cultivating helps to conserve soil moisture. Consequently, less watering is required if the plants are kept well cultivated. For the first year or two after trees and shrubs are transplanted, a circle about

three feet in diameter around the plants should be kept free of weeds and grass. The soil of this cultivated area should be left loose on top. After the second year, trees and shrubs will require somewhat less cultivation and can better compete with the weeds and grass.

The cultivated area around a young tree planted on a lawn should be about three inches lower than the surrounding sod so that the bare spot will be less conspicuous. It will also serve the purpose of holding some water for the tree after each rain.

Pruning.—Trees and shrubs require no pruning the first year after the cutting back they receive when transplanted. The amount they should receive the second and subsequent years will depend upon their vigor and the purpose they are intended to serve.

The early spring blooming shrubs, such as *Spirea van Houttei*, *Deutzia*, *Weigelia*, and *Snowball*, produce their flowers on wood produced the previous summer. Consequently, these should be pruned as soon as they stop blooming in the spring, in order that they may have time to produce new growth which will blossom the following spring. Shrubs, such as *Althea* and *Hydrangea*, which bloom in late summer, produce their flowers on new growth. These should be pruned during the winter so that they will send out new spring growth which will blossom in late summer. As a general rule, early spring flowering shrubbery should be pruned in the spring after it blossoms. Late summer shrubbery should be pruned in winter.

Hedge plants should be sheared back at intervals during the summer to keep them to the proper size and shape. Evergreen hedges should not be cut back during the winter as this robs them of their foliage which cannot be replaced until spring.

Fertilizing.—Ornamental plantings should be fertilized once each year. If a supply is available, a coating of stable manure may be spread around the plants in the early spring and worked into the soil. Commercial fertilizers may also be used for this purpose. A mixture containing 4 percent nitrogen, 8 percent phosphoric acid, and 4 percent potash should be satisfactory for this purpose. A young tree should receive one pound of fertilizer the first year. This is increased by one pound each year until the tree receives an annual application of eight or ten pounds. Shrubs receive proportionately according to their size. The fertilizer should not be applied close to the trunk of the tree, but should be spread from one to six or more feet out and worked into the soil.

Controlling Insects and Diseases.—There are comparatively few diseases and insects which attack our ornamental plants, especially the trees and shrubs. These plant enemies can be further reduced by selecting plants resistant to them.

Mildew.—This disease attacks a number of our flowering plants, but is particularly harmful to certain varieties of roses, especially the Crimson Rambler and the Dorothy Perkins. For this reason these roses have given place largely to more resistant varieties. It often becomes necessary, however, to spray or dust plants against mildew. One of the most common methods of control is to dust the plants with sulphur. The dust should be applied before the disease makes much headway, and should be repeated every ten days or two weeks during the growing season.

Plant Lice and the Red Spider.—Large numbers of our shrubs and flowering plants are attacked by these

two insects. The most common method of controlling plant lice, and to some extent the red spider, is to spray the plants with one-fourth pint of nicotine sulphate and 3 pounds of soap dissolved in 50 gallons of water. The red spider works on the under side of the leaves. It is so small that it can hardly be seen without a magnifying glass. It is even more troublesome to control than plant lice. Spraying plants with lime-sulphur mixtures, the same as that used for spraying peach trees in summer, will aid also in the control of the red spider. Spraying the plants thoroughly with a brisk stream of water from a hose will be helpful in the control of red spider.

Nematode.—The nematode attacks the roots of a great many ornamental plants. The selection of resistant varieties and keeping susceptible plants off of infested soil for three or four years are two of the practices of handling this plant parasite. The importance of not bringing in the nematode to one's premises through infested plants or soil can hardly be over-emphasized.

Often the soil of plant beds in the flower garden becomes infected with serious diseases as *Sclerotium* blight or some of the wilts and all the plants will die. In such cases the species of plants which have suffered from the disease should be kept off that particular bed for a period of two or three years.

SUGGESTIONS FOR STUDY

QUESTIONS FOR CLASS DISCUSSION

1. What should be the first step in beautifying either public or private grounds?
2. What two types of plans are used?
3. Why is a knowledge of plants necessary in making the plans?

4. What are the five general groups of plants used in landscape work?
5. How should trees and shrubs be located on the grounds?
6. How are vines used?
7. How are herbaceous and flowering plants used?
8. How are plants procured for ornamental purposes?
9. Under what conditions should ornamental plants be propagated at home?
10. Give some directions for preparing the land and setting out trees and shrubs.
11. How should the flower garden be prepared and planted?
12. What are the necessary steps in making a lawn?
13. How would you water, cultivate, prune, and fertilize ornamental plants?
14. How are insects and diseases of ornamental plants controlled?

SUGGESTED EXERCISES

1. Draw a plan of your school or home grounds and indicate locations of plantings for their improvement.
2. Visit nearby parks or ornamental grounds and study the landscape plans. Learn to identify the ornamental plants you find growing there.
3. Visit the nearby nurseries which sell ornamental plants, study their methods of propagation, culture, and sale of plants.

SEASONAL WORK WITH ORNAMENTALS

September, October, and November

Prune late flowering shrubbery. Sow grass seed for winter lawn. Protect tender plants against cold before winter weather sets in. Set bulbs for spring blooming. Sow seed of poppies, sweet peas, and pansies for spring blooming. Keep fallen leaves raked from lawn.

December, January, and February

Prune out dead and diseased limbs from shade trees. Prepare window boxes and hotbeds for sowing seed of early spring

flowering annuals or perennials. Make cuttings of shrubbery to be rooted in the nursery. Give clumps of shrubbery and plant beds a heavy dressing of stable or barnyard manure. Set out trees and shrubs. Repair walks and driveways.

March, April, and May

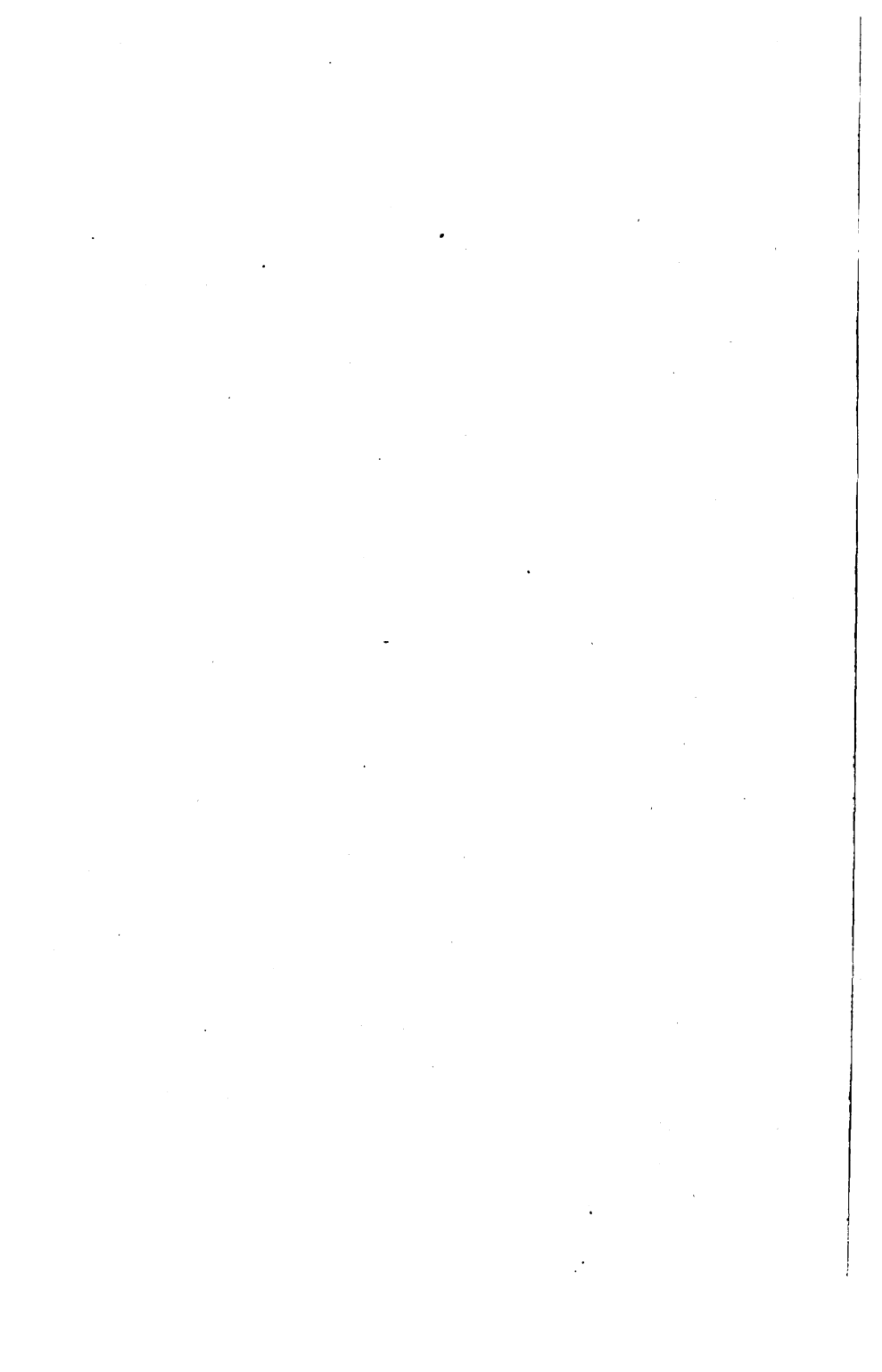
Trees and shrubs may be planted in the upper South in March. Water newly planted trees and shrubs during dry weather. Begin mowing the lawns in the spring. Prepare and plant the flower garden. Keep herbaceous plants and newly set shrubbery well cultivated.

June, July, and August

Take up and divide bulbs as soon as tops die down. These may be reset as soon as divided. Continue to water plants in dry weather. Mow the lawns once each week.

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APPENDIX

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FOOD PRESERVATION

Horticultural crops are produced for *home* and *market*. No land on the farm contributes so much to living-at-home as the vegetable garden and the orchard. But the home orchard and the "year-around" garden supply fresh fruits and vegetables for only a portion of the year. Some of the foods we like best are in season for only a short period. These things mean, as you are aware, that a goodly portion of the home food supply must be preserved and stored.

In the appendix of this text you will find a number of tables that will be helpful in planning an adequate family food budget and in making plans for preserving the products grown in the garden and orchard. The following tables are given: Table I, *Per Capita Food Requirements*; Table II, *Horticultural Crops for Family of Five*; Table III, *Ways of Processing Vegetables*; Table IV, *Ways of Processing Fruits*; Table V, *Fruits Suitable for Freezing*; Table VI, *Information on Dehydration of Fruits and Vegetables*; Table VII, *Information on Rehydration and Serving Vegetables*. All of these tables, unless otherwise indicated are the work of Dr. J. G. Woodroof, Food Technologist, Georgia Experiment Station, Experiment, Georgia. (Dr. Woodroof also made most of the line drawings used in this text)

Canning, freezing, and dehydrating can be carried on in the home. Equipment designed for home use in all three methods has been perfected. Of course, canning equipment has been available for years. The other two processes—freezing and dehydrating—a much newer. Also, in the community food preservation centers of progressive communities will be found the equipment for one or all forms of food preservation. In these labor-saving plants it is a simple task to preserve enough food to meet the annual requirements of the thrifty families that produce their own food supplies.

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TABLE I—PER CAPITA FOOD REQUIREMENTS

<i>Food Items</i>	<i>No. Servings per Week</i>	<i>Approximate Amt. per Serving</i>	<i>Yearly Re- quirements per Person</i>
Milk.....	14-21	1 cup	90 gallons
Eggs.....	7	1 egg	30 dozen
Lean meat.....	7-14	$\frac{1}{4}$ to $\frac{1}{3}$ lb.	130 pounds
Butter.....	21	$\frac{1}{2}$ to 1 tablespoonful	25 pounds
Lard and fat.....	21	1½ tablespoons	40 pounds
Tomatoes.....	7	$\frac{1}{2}$ cup to $\frac{1}{4}$ lb.	100 pounds
Potatoes.....	7-14	$\frac{1}{4}$ to $\frac{1}{3}$ lb.	156 pounds
Leafy, green, yellow vegetables.....	14-21	$\frac{1}{2}$ cup to $\frac{1}{4}$ lb.	173 pounds
Other vegetables.....	4-7	$\frac{1}{2}$ cup to $\frac{1}{4}$ lb.	104 pounds
Fruits.....	14	$\frac{1}{4}$ to $\frac{1}{3}$ lb.	156 pounds
Nuts, beans, peas....	1-2	2 to 4 oz.	13 pounds
Cereals and bread....	21	$\frac{1}{8}$ to $\frac{1}{6}$ lb.	208 pounds
Sweets.....	14	Small or large spoonful	40 pounds

From *Food Processing*, Turner E. Smith & Co.

TABLE II—HORTICULTURAL CROPS FOR FAMILY OF FIVE

<i>Kinds of Food Products</i>	<i>Average Amount Family of Five</i>	<i>Production Plans to Supply Needs</i>
Vegetables and Truck and Fruit		$\frac{1}{2}$ acre garden, 1½ or 2 acres of truck
Tomatoes	450 pounds	$\frac{1}{8}$ acre
Potatoes	780 pounds	$\frac{1}{4}$ acre
White Sweet		
Leafy, green, yellow vegetables	866 pounds	$\frac{1}{8}$ -½ acre
Other vegetables	520 pounds	$\frac{1}{8}$ -¼ acre
Watermelon and cantaloupes		$\frac{1}{2}$ acre
Peanuts, dried beans and peas	75 pounds	$\frac{1}{4}$ acre
Cane or sorghum	100 pounds	$\frac{1}{4}$ acre
Fruits	780 pounds	$\frac{1}{2}$ -1 acre of home orchard plus 500 strawberry plants and other berries

From *Food Processing*, Turner E. Smith & Co.

TABLE III—WAYS OF PROCESSING VEGETABLES

Vegetable	Use or Ship Fresh	Store in Cool Place	Can and Store	Freeze and Store	Dry and Store	Make Pickles	Make Relish	Can Juice	Make Hot Sauce
Asparagus.....	+	+	++	++	+	+	+	+	+
Bean, lima.....	+	+	++	++	+	+	+	+	+
Bean, snap.....	+	+	++	++	+	+	+	+	+
Beet.....	+	+	++	++	+	+	+	+	+
Broccoli.....	+	+	++	++	+	+	+	+	+
Cabbage.....	+	+	++	++	+	+	+	+	+
Cantaloupe.....	+	+	++	++	+	+	+	+	+
Carrot.....	+	+	++	++	+	+	+	+	+
Cauliflower.....	+	+	++	++	+	+	+	+	+
Collard.....	+	+	++	++	+	+	+	+	+
Corn.....	+	+	++	++	+	+	+	+	+
Cucumber.....	+	+	++	++	+	+	+	+	+
Eggplant.....	+	+	++	++	+	+	+	+	+
Horse radish.....	+	+	++	++	+	+	+	+	+
Kale.....	+	+	++	++	+	+	+	+	+
Mustard green.....	+	+	++	++	+	+	+	+	+
Okra.....	+	+	++	++	+	+	+	+	+
Onion.....	+	+	++	++	+	+	+	+	+
Parasnip.....	+	+	++	++	+	+	+	+	+
Pea, English.....	+	+	++	++	+	+	+	+	+
Pea, field.....	+	+	++	++	+	+	+	+	+
Pepper, sweet.....	+	+	++	++	+	+	+	+	+
Pepper, hot.....	+	+	++	++	+	+	+	+	+
Pumpkin.....	+	+	++	++	+	+	+	+	+
Rhubarb.....	+	+	++	++	+	+	+	+	+
Rutabaga.....	+	+	++	++	+	+	+	+	+
Spinach.....	+	+	++	++	+	+	+	+	+
Squash, summer.....	+	+	++	++	+	+	+	+	+
Potato, sweet.....	+	+	++	++	+	+	+	+	+
Potato, white.....	+	+	++	++	+	+	+	+	+
Tomato.....	+	+	++	++	+	+	+	+	+
Turnip.....	+	+	++	++	+	+	+	+	+
Turnip green.....	+	+	++	++	+	+	+	+	+
Watermelon.....	+	+	++	++	+	+	+	+	+

Vegetables eaten raw as salads—lettuce, radish, celery, parsley, endive, tomato, cucumber, sweet watermelon—may be stored under refrigeration for as long as three weeks, but are not to be processed.

As particular type of handling is or can be done on a commercial scale in Georgia.

One or more "+" indicates the degree of suitability of the product for handling. — indicates that the product is unsuitable.

TABLE IV—WAYS OF PROCESSING FRUITS

Fruit	Use or Ship Fresh	Store in Cool Place	Can and Store	Freeze and Store	Dry and Store	Make Pickles	Freeze or Can Juice	Make Syrup of Juice	Make Jelly	Make Jam or Preserves	Make Relish or Sauce
Apple.....	+++*	+++*	-	+	++	-	++	+	++	-	++
Blackberry.....	+++*	++	+++*	++	+	-	++	+	++	+	-
Blueberry.....	+++*	+++*	+++*	+++*	-	-	++	-	++	+	-
Cherry.....	+++*	++	+++*	+++*	-	-	++	+	++	+	-
Dewberry.....	+++*	++	+++*	+++*	-	-	++	+	++	+	-
Fig.....	+++*	++	+++*	+++*	++	-	++	-	++	+	-
Grape, bunch.....	+++*	++	++	++	-	-	++	++	++	+	-
Grape, muscadine.....	+++*	+	-	-	-	-	++	++	++	+	-
Peach.....	+++*	++	+++*	++	++	++*	++	+	++	+	++
Pear.....	+++*	+++*	+++*	-	++	++	-	-	-	+	++
Persimmon.....	+++*	++	+++*	-	-	-	-	-	-	-	++
Plum.....	+++*	++	++	-	++	-	-	-	-	+	++
Raspberry.....	+++*	++	+++*	+++*	++	-	++	++	++	+	-
Strawberry.....	+++*	++	++	+++*	++	-	++	++	++	+	-

All fruits may be eaten raw, and processed only as a means of extending the period of consumption. Most clean, sound, unbruised fruit may be stored under refrigeration from one to three weeks, but must be used immediately after removal from storage.

* This particular type of handling is or may be done on a commercial scale in Georgia.

One or more +s indicates the degree of suitability of the product for handling, - indicates that the product is unsuitable.

TABLE V—FRUITS SUITABLE FOR FREEZING

Name	Suitability for Freezing	Treatment Before Freezing	Form in Which Frozen	Suitable Varieties	Loss in Weight During Processing		Season of Operation	Uses of Frozen Products
					Minimum	Maximum		
Apple.....	Good.....	Treat with sulphur dioxide, scald, or subject to vacuum, to prevent browning	Peeled, cored, sliced, packed in 50% syrup or coat with sugar 4 parts to 1	Baldwin, Winesap, other high acid varieties suitable for pies	per cent 50	per cent 60	Fall-winter	Pie, cobbler, apple butter
Blackberry	Good.....	Wash, grade.....	Packed dry, in 50% syrup or coat with sugar, 4 to 1	Crandall, Eldorado, Lawton	10	25	Early summer	Pie, cobbler, jam, wine, brandy
Blueberry	Excellent...	Wash, grade.....	Packed dry, in 50% syrup or coat with sugar, 5 to 1	All high-quality, small-seeded varieties	10	25	Summer....	Dessert, pie
Cherry.....	Excellent...	Wash, remove pits	Packed in 60% syrup or coat with sugar, 4 to 1	Early Richmond....	30	40	Early summer	Pie, cobbler, sundaes, ice cream
Dewberry...	Very good...	Wash, grade.....	Packed dry, in 60% syrup or coat with sugar, 4 to 1	Boysenberry, Youngberry	10	25	Spring.....	Pie, cobbler dessert
Fig.....	Excellent...	Peel.....	Packed in 50% syrup or coat with sugar, 4 to 1	Brown Turkey, Celestial, Magnolia	25	50	Summer....	Dessert, preserves

Name	Suitability for Freezing	Treatment Before Freezing	Form in Which Frozen	Suitable Varieties	Loss in Weight During Processing		Season of Operation	Uses of Frozen Products
					Minimum	Maximum		
Grape (Muscadine).	Fair.....	Remove from stems	Packed dry, in 50% syrup or coat with sugar, 5 to 1	Scuppernon, Stuckey, Thomas, Hunt	per cent 5	per cent 15	Fall.....	Pie, preserves, wine, dessert
Peach.....	Fair.....	Treat with citric acid, sulphur dioxide, or vacuum to prevent browning	Peeled, pitted, sliced, packed in 50% syrup or coated with sugar, 4 to 1	Hale, Halehaven, Georgia Belle	45	55	Summer...	Pie, cobbler, ice cream, dessert, wine, brandy stewed peaches
Persimmon.	Good.....	Wash, grade.....	Sectioned, coated with sugar, 5 to 1	Japanese.....	10	20	Late fall....	Dessert
Plum.....	Fair.....	Remove seed of large fruits only	Coated with sugar, 5 to 1	Red June, Italian prune, other high-flavored varieties	15	40	Early summer	Sauce, stewed
Raspberry..	Excellent...	Wash, grade.....	Packed dry, in 50% syrup or coat with sugar, 5 to 1	Latham, Chief, other high-flavored red varieties	10	20	Summer.....	Pie, dessert, ice cream, sundae
Strawberry.	Excellent...	Wash, grade, may also be sliced	Packed in 60% syrup or coat with sugar, 4 to 1	Blakemore, Klon-dyke, Premier, and new varieties from Tenn. and La.	10	25	Spring.....	Pie, cobbler, ice cream, sundae, preserves, dessert

TABLE VI—VEGETABLES SUITABLE FOR FREEZING

Name	Suitability for Freezing	Treatment Before Freezing	Form in Which Frozen	Suitable Varieties	Loss in Weight During Processing		Season of Operation	Uses of Frozen Products
					Minimum	Maximum		
Asparagus...	Very good...	Blanch 3-4 min. in steam...	Young, green tips...	Martha Washington, Mary Washington	per cent 40	per cent 65	April-May...	Cooked vegetable, salad, soup.
Beans, lima...	Excellent...	Blanch 1-2 min. in steam...	Green seed...	Baby potato, bush; Fordhook, bush; Henderson, bush...	50	70	Summer...	Cooked vegetable, soup.
Beans, string...	Very good...	Blanch 2 min. in steam...	Immature green pods...	Giant Stringless bush; Kentucky wonder, pole; Tendergreen, bush; Stringless Refugee, bush...	20	40	Summer...	Cooked vegetable, soup.
Beets...	Good...	Blanch 2-3 min. in steam...	Peeled, diced...	Detroit Dark Red...	30	50	Spring-fall...	Cooked, vegetable, salad.
Broccoli...	Excellent...	Blanch 3-4 min. in steam...	Sectioned flower heads...	Italian Green Sprouting...	40	60	Spring-fall...	Cooked vegetable, salad.
Brussels sprouts...	Excellent...	Blanch 2-3 min. in steam...	Axillary buds...	Long Island improved...	30	50	Spring-fall...	Cooked vegetable, salad.
Carrots...	Very good...	Blanch 2-3 min. in steam...	Sliced or diced...	Danver Half-long, Chantenay Half-long...	15	30	Spring-fall...	Cooked vegetable, soup, salad.
Cauliflower...	Good...	Blanch 3-4 min. in steam...	Sectioned heads...	Early Snowball...	30	70	Spring-fall...	Cooked, vegetable, salad.
Corn...	Excellent...	Blanch 6-8 min. in steam...	On cob...	Cherokee, Golden Bantam hybrids and other yellow kinds...	10	20	Summer...	Cooked, vegetable.
Eggplant...	Fair...	Blanch 1-2 min. in steam...	Whole grain...	Cherokee...	60	80	Summer...	Cooked vegetable, soup, salad.
		Blanch 2-3 min. in steam...	Peeled, sectioned...	Black Beauty...	40	60	Summer...	Scalloped.

Name	Suitability for Freezing	Treatment Before Freezing	Form in Which Frozen	Suitable Varieties	Loss in Weight During Processing		Season of Operation	Uses of Frozen Products
					Minimum	Maximum		
Kale.....	Very good..	Blanch 2-3 min. in steam.....	Young leaves.....	Dwarf Green Curled	per cent 15	per cent 30	Fall-winter...	Cooked vegetable, table.
Mustard....	Good.....	Blanch 2-3 min. in steam.....	Young leaves.....	Mammoth, Southern Curled.....	30	40	Fall-winter-spring....	Cooked vegetable, table.
Okra.....	Good.....	Blanch 2-3 min. in steam.....	Young pods.....	Clemson Spineless, White Lightning..	20	60	Summer.....	Cooked vegetable, soup.
Parsnip....	Good.....	Blanch 2-3 min. in steam.....	Sliced or diced.....	Sugar.....	20	40	Spring-fall....	Cooked vegetable, table.
Peas, green..	Excellent..	Blanch 1 min. in steam.....	Green seed.....	Laxton's Progress, Thomas Laxton, Alderman.....	60	65	Spring.....	Cooked vegetable, salad, soup.
Peas, field..	Very good..	Blanch 1 min. in steam.....	Tender seed.....	Crowder, Blackeye..	50	70	Summer-fall....	Cooked vegetable, table.
Pimiento...	Excellent..	Blanch 1-2 min. in steam.....	Sectioned, peeled, pods.....	Perfection.....	40	60	Fall.....	Mixed with meats, salad, soup.
Pumpkin....	Very good..	Steamed under pressure 10 min....	Puree.....	Any deep yellow kind	7	16	Fall.....	Pie, dessert.
Rhubarb....	Excellent..	Blanch 2-3 min. in steam.....	Sectioned leaf stalks	Victoria.....	20	40	Summer-fall....	Pie, sauce, dessert.
Rutabaga...	Good.....	Pre-cooked.....	Puree.....		20	30	Fall.....	Cooked vegetable, table.
Spinach....	Excellent..	Blanch 1-2 min. in steam.....	Young leaves.....	Giant, King of Denmark.....	30	50	Spring-fall....	Cooked vegetable, table.
Squash....	Good.....	Blanch 2-3 min. in steam.....	Peeled, seeded, sliced.....	Golden Hubbard, African.....	30	50	Spring.....	Cooked vegetable, table.
Sweet Potato	Excellent..	Steamed under pressure 20 min....	Whole, slices, puree	Puerto Rico or other yellow kind.....	25	25	Fall-winter....	Cooked vegetable, pie, dessert.
Tomatoes...	Good.....	Blanch 1-2 min. in steam.....	Whole.....	Any deep red kind with small fruit..			Summer.....	Cooked vegetable, salad, soup.

TABLE VII—INFORMATION ON DEHYDRATION OF FRUITS AND VEGETABLES

Material	Suitability for Dehydration	Varieties or Kinds	Form for Dehydration	Treatment Before Dehydration	Tray Loading per Sq. Ft.	Product (One Bushel)			Moisture Content		Average Time for Dehydration
						Original	Prepared	Dehydrated	Original	Dehydrated	
						pounds	pounds	pounds	percent	percent	hours
Bean, lima	good	Henderson type	immature seed	shell, blanch 4-6 min.	1.0	36	24	8.48	66.5	5-10	5-6
Bean, snap	good	stringless type	immature pods	snap, blanch 5-7 min.	1.0	30	20	2.34	88.9	5-10	5-6
Beet	good	Detroit dark red	sliced, peeled roots	blanch 6-9 min.	1.5	56	40	5.33	87.6	7-10	7-8
Cabbage	good	any hard head type	sliced heads	blanch 3-6 min.	1.0	38	32	2.54	92.4	5-10	5-6
Carrot	very good	those with yellowish color	sliced, peeled roots	blanch 8-10 min.	1.5	50	43	5.30	88.2	7-10	6-7
Celery	good	any	sliced leaf stalks	blanch 1 min.	1.0	30	20	1.32	93.7	5-10	3-4
Collard	good	collard-type	tender leaves	blanch 3-4 min.	.7	25	13	1.83	88.6	5-10	5-6
Corn	very good	sweet or hybrid	whole grains cut from cob	blanch 15-30 min. on cob	1.7	35	12	3.30	73.9	5-10	4-5
Eggplant	good	Black Beauty	sliced fruit	blanch 3-4 min.	.8	33	26	2.02	92.7	6-10	6-7
Garlic	very good	any	sliced bulbs	wash	1.0	57	24	1.45	94.2	5-10	10-12
Kale	good	green, curled	tender leaves	blanch 2 min.	.7	18	16	2.24	86.6	5-10	4-5
Mustard	good	Southern curled	tender leaves	blanch 2-3 min.	.7	18	16	1.30	92.2	5-10	4-5
Okra	good	dwarf	pods 1/2 grown	blanch 3-4 min.	1.0	30	18	1.92	89.8	5-10	6-7
Onion	good	most all	sliced bulb	none	1.3	57	40	5.23	87.5	5-10	12-15
Parsnip	good	most all	sliced roots	blanch 8-10 min.	1.5	50	36	8.13	79.6	5-8	6-7
Pea, English	very good	most all	immature seed	blanch 3-4 min.	1.0	30	20	5.42	74.3	5-8	5-6
Pea, field	very good	Crowder, Lady	immature seed	blanch 3-4 min.	1.0	30	20	7.20	65.9	5-8	5-6
Pepper, hot	very good	Buckeye	whole, ripe pods	core, blanch 2-3 min.	.6	25	13	1.48	89.2	5-8	5-6
Pepper, pimiento	good	Perfection	sliced, ripe pods	roast, wash	.8	25	13	1.37	90.0	5-8	7-8

Material	Suitability for Dehydration	Varieties or Kinds	Form for Dehydration	Treatment Before Dehydration	Tray Load- ing per Sq. Ft.	Product (One Bushel)				Moisture Content		Average Time for Dehydration <i>hours</i>
						Original	Pre- pared	Dehy- drated	Dehy- drated	Original	Dehy- drated	
Potato, Irish.	very good..	white.....	sliced, peeled potatoes	blanch 5-7 min....	1.3	60	53	12.41	77.8	5-6	10-11	
Potato, sweet	very good..	yellow yam type African.	sliced, peeled potatoes	blanch 10-12 min.	1.5	60	40	13.99	68.5	10-12	12-14	
Pumpkin.	good.....		peeled, sliced mature fruit	blanch 5-7 min....	1.5	56	28	2.81	90.5	5-8	10-12	
Rhubarb.	good.....	Victoria.....	sliced leaf stalks..	blanch 4-5 min....	.8	30	14	0.76	94.9	6-7	4-5	
Rutabaga.	very good..	most all.....	sliced, peeled roots.	blanch 4-6 min....	1.5	56	48	5.52	89.1	5-8	6-7	
Sage.....	excellent..	all.....	leaves and tender shoots	wash.....	.5	18	16	1.72	90.0	7-8	3-4	
Spinach.	good.....	King of Denmark, Giant	tender leaves.....	blanch, water 2-3 min.	.5	18	16	1.24	92.7	6-7	4-5	
Squash.	very good..	summer.....	sliced, peeled immature fruit	blanch 3-4 min....	1.5	56	52	5.27	90.4	5-6	5-6	
Tomato.	fair.....	deep red kind	sliced ripe fruit...	none.....	1.0	53	36	2.27	94.1	6-8	5-6	
Turnip.	good.....	most all.....	sliced, peeled turnips	blanch 6-8 min....	1.5	56	48	4.61	90.9	5-6	6-7	
Turnip green	good.....	Shogoin, Southern	tender leaves.....	blanch, water 3-4 min.	.5	18	16	1.77	89.5	5-6	4-5	
Apple.....	very good..	prize all cooking varieties	slices 1/8" thick...	peel, slice, sulphur 15 min.	1.5	48	24	4.3	84.1	10-15	6-8	
Berry.....	good.....	dewberries blackberries	whole.....	wash, drain.....	1.0	43	40	6.8	85.0	10-15	6-8	
Fig.....	very good..	Celes, Brown Turkey	whole or sliced...	wash, sulphur 10 min.	3.0	48	36	9.3	78.0	15-20	10-15	
Peach.....	very good..	Hale Haven, Goldfinch, Alberta	halves, peeled, unpeeled	peel, sulphur halves 30 min.	2.5	48	25	3.8	86.9	15-17	20-24	
Pear.....	very good..	Keiffer, LeConte Baldwin	peeled, quarters or eighths	peel, slice, sulphur 25 min.	2.5	50	24	4.7	82.7	12-15	10-12	

TABLE VIII—INFORMATION ON REHYDRATION AND SERVING VEGETABLES

Material	Form in Which Rehydrated	Approximate Amount to Serve Six		Water Needed to Rehydrate and Cook This Amount	Time Required to Rehydrate at 160° F.	Time Required to Cook	Suggested Uses of Rehydrated Product
		cups	ounces		minutes	minutes	
Bean, lima	whole beans	2	6	5-6	90	40	battered, seasoned with fat, baked, casserole, soup, loaf, succotash
Bean, snap	cut beans	1½	3	6	90	40	battered, seasoned with fat, with sauce, succotash, casseroles, salad
Beet	slices	1	2½	3	90	20	battered, Harvard, pickled, salad
Cabbage	shredded	3	1.8	4	22	3	battered, sautéed, creamed, scalloped, slaw, soup
Carrot	slices	1	3	5	90	20	battered, creamed, toasted, sautéed, glazed, soup, with peas
Celery	slices, ground	1½	2	3	30	30	ground; seasoning soup, meats, cocktail, pickles, salad
Collard	greens	5	1.8	5	30	30	slices; battered, creamed, soup
Corn	whole grains	1¾	4.5	4-5	30	15	battered, seasoned with fat, with sauce
Eggplant	slices	2	2	3-4	40-50	30	pudding, scalloped
Garlic	ground	season to taste	5	none			sautéed, casserole
Kale	greens	5	1.8	5	30	30	seasoning; soup, salad, meat, vegetable, scalloped, au gratin, creamed
Mustard	greens	7	2	6	35	15	battered, scalloped, au gratin, seasoned with fat
Okra	whole or cut pods	1	2	4	40	15	battered, fried, soup, gumbo
Onion	shredded or ground	1½	1.4	3	30	7	ground; seasoning soup, salad, meat, vegetable, pickle
Parsnip	slices	1	3.2	4	40	30	slices; creamed, fried, onion rings, garnish, battered, sautéed, creamed, glazed
Pea, English	whole or split peas	2	6-8	5-6	90	40-50	battered, creamed, scalloped, au gratin, soup, puree, timbales

Material	Form in Which Rehydrated	Approximate Amount to Serve Six		Water Needed to Rehydrate and Cook This Amount	Time Required to Rehydrate at 160° F.	Time Required to Cook	Suggested Uses of Rehydrated Product
		cups	ounces		minutes	minutes	
Pea, field.....	whole or split peas.	2	6-8	5-6	90	40-60	buttered, seasoned with other fat
Pepper, hot.....	whole pods or ground	season to taste	—	none	—	—	seasoning: meat, vegetables, soup, salad
Pepper, pimiento..	sliced pods or ground	$\frac{1}{4}$	.2	$\frac{1}{4}$	40-60 (cool water)	no cooking	sandwich filling, sauce, garnish, salad, loaf
Potato, Irish.....	slices Julienne.....	2 $\frac{1}{4}$	5-6	4	40-60	30	cream, hashed brown, shocasting, chips, croquettes, au gratin, mashed, lyonnaise, rice, scalloped, salad
Potato, sweet.....	slices Julienne.....	2	6.4	3	25	5	buttered, candied, mashed, soufflé, fried pie
Pumpkin.....	slices.....	1	1-2	4	40	10	pie, baked, candied, with sugar and cream
Rhubarb.....	slices.....	1 $\frac{1}{4}$	2	3	30	30	stewed, pie, conserve
Rutabaga.....	slices.....	2	2	4	30	30	buttered, seasoned with fat, with cheese
Sage.....	ground.....	season to taste	—	none	—	—	seasoning: meat, poultry stuffing; making tea
Spinach.....	greens.....	6	2	5	40	15	boiled and buttered, creamed, scalloped, au gratin, mold, soufflé, with cheese
Squash.....	slices.....	2	2.5	3 $\frac{1}{2}$	60-75	30-35	buttered, creamed, fried, casserole
Tomato.....	slices or ground.....	2	2	4	30	20	stews, soup, sauce, loaf
Turnip.....	slices.....	2	2	4	30	20	buttered, seasoned with fat, mashed, creamed, with cheese
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Watermelons—See Melons

